SSP 58309B

Payload Training Implementation Plan

International Space Station Program

January 2002

Revision B

National Aeronautics and Space Administration
International Space Station Program
Marshall Space Flight Center
Huntsville, Alabama

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REVISION AND HISTORY PAGE

REV.	DESCRIPTION	PUB. DATE
-	Baseline Release per NASA Letter OL/MSFC-99-001	12-08-99
A	Revision A per NASA Letter OL/MSFC-99-001	10-15-01
B	Revision B per NASA Letter OL/MSFC-99-001	06-05-02

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INTERNATIONAL SPACE STATION PROGRAM

NASA PAYLOAD TRAINING IMPLEMENTATION PLAN

CONCURRENCE

Concurred by:	Debrah Underwood	FD35
	MSFC TRAINING REPRESENTATIVE	ORGN
	/s/ Debrah Underwood	03/26/02
	SIGNATURE	DATE
Concurred by:	Charles Brown	DT
	ITCB REPRESENTATIVE	ORGN
	/s/ Charles Brown	03/08/02
	SIGNATURE	DATE
Concurred by:	Doug Sander	OZ5
	ISSPO REPRESENTATIVE	ORGN
	/s/ Doug Sander	03/26/02
	SIGNATURE	DATE
Concurred by:	Barbara Corbin	DV4
	SSTF/PTC REPRESENTATIVE	ORGN
	/s/ Barbara Corbin	03/20/02
	SIGNATURE	DATE

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ABSTRACT

The National Aeronautics and Space Administration (NASA) Payload Training Implementation Plan (PTIP) will detail payload training requirements and processes for United States (U.S.) Payload Developers (PD). This document will supplement the NASA Training Implementation Plan by specifying payload-specific information.

KEY WORDS

Curriculum

Ground Support Personnel

Increment Minus

Payload Developer

Payload Instructors

Payload Training

Payload Training Integrator

Payload Types/Phases

Simulators

Simulation Engineer

Space Station Training Facility/Payload Training Capability

Station Crew

Training Strategy Team

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INTERNATIONAL SPACE STATION PROGRAM

PAYLOAD TRAINING IMPLEMENTATION PLAN

LIST OF CHANGES

JANUARY 2002

All changes to paragraphs, tables, and figures in this document are shown below:

CCBD #	ENTRY DATE	CHANGE	PARAGRAPH(S)
PB3-02-0010	September 1999	Baseline	All
PB3-02-0093	August 2001	Revision A	All
PB3-02-0010/A	January 2002	Revision B	All

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TABLE OF CONTENTS

TABLE OF CONTENTS (CONTINUED)

TABLE OF CONTENTS (CONTINUED)

TABLE OF CONTENTS (CONTINUED)

LIST OF FIGURES

LIST OF TABLES

SECTION 1, INTRODUCTION

1.1 PURPOSE

This document defines the NASA PTIP for the International Space Station (ISS) Program. This plan will address concepts, processes, tasks, and personnel required to perform training on U.S. payloads or experiments for crew and Ground Support Personnel (GSP).

1.2 SCOPE

This plan describes payload training-related activities performed by NASA and the U.S. Payload Developer (PD) community for the ISS Program. While facilities, capabilities, and personnel become available during the assembly phase, the processes defined here will allow for flexibility in accomplishing payload training objectives.

The overall concept, definition, and template for payload training will be described in this document. The specific roles and responsibilities of all individuals, organizations, and groups involved in this implementation plan will be defined. The entire payload training process flow will be defined in detail. This definition will include discussion of the facilities which are utilized during payload training, the documentation related to payload training, and the processes and activities which will be performed to plan, develop, implement, and administer payload training for both crew and GSP for the ISS.

The technical training which must occur for processing of payloads at Kennedy Space Center (KSC) and other launch sites is not included in this plan. Descriptions and implementation plans for this training may be found in the Guide for Space Station Processing at KSC, K-CM-05.3.2-BL.

1.3 CHANGE AUTHORITY

This document is written under the authority of the Payload Operations Integration Function (POIF) and will be under the configuration control of the NASA Payload Operations Control Board (NPOCB) once baselined.

1.4 GOALS OF PAYLOAD TRAINING

The accomplishment of the goals of ISS payload training will result in a crew and GSP that can function in their respective operational environments with the skills and knowledge required to operate and service the payloads or experiments aboard the ISS to the

satisfaction of the PDs. Each payload training goal listed below briefly describes what the Program is striving for, with the support of the PDs, when training crew. Likewise, the payload GSP should also be knowledgeable and trained in each of the areas listed below to the extent each position requires that knowledge to perform its support function of the crew or payload/experiment.

A. Payload Science. Crewmembers will be knowledgeable of the science, technology, and commercial research aspects of the payloads or experiments each is assigned to operate. The extent of this knowledge will depend on the requirements of each payload or experiment so as to maximize scientific return.

B. Payload and Laboratory Support Equipment (LSE) Operations. Once on orbit, crewmembers should require little or no training support from the ground to locate, activate, operate, respond to malfunctions, perform On-Orbit Maintenance (OOM), safe, and deactivate each payload or experiment and LSE as required by approved payload operations procedures. The exception to this would be on-board or just-in-time training.

C. Payload Safety. Crewmembers will be cognizant of all individual payload or experiment hazards and be capable of responding to any safety emergency that might involve the payload or experiment.

D. Payload Flight Rules and Regulations. Crewmembers will understand fundamental payload or experiment flight rules as a subset of the overall ISS flight rules including an understanding of core systems management and control responsibilities delegated to the Payload Operations Integration Center (POIC) at Marshall Space Flight Center (MSFC), Mission Control Center - Houston (MCC-H), Mission Control Center - Moscow (MCC-M), Space Station Control Center (SSCC) at Johnson Space Flight Center (JSC), and other Telescience Support Centers (TSC) or remote sites. Crewmembers will understand fundamental payload regulations as documented in the Payload Operations Guidelines and Constraints to ensure compliance with overall payload or experiment constraints and noninterference requirements.

E. Space-to-Ground (S/G) Payload Coordination. Crewmembers will be capable of interacting with the POIC and TSCs or remote sites to meet the requirements of payload or experiment operations and the attainment of science.

F. Payload-to-Systems Interactions. Crewmembers will be able to interact with the ISS systems and Payload Support System (PLSS) hardware and software to make system reconfigurations and provide appropriate resource allocations.

G. Payload-to-Payload and Payload-to-LSE Interactions. Crewmembers will be able to make software and hardware reconfigurations to support payload/experiment-to-payload/experiment and payload/experiment-to-LSE interactions.

H. On-Board Short-Term Plans. Crewmembers will be able to interact with on-board software, the POIC, and TSCs or remote sites to receive and modify on-board short-term plans for payloads or experiments.

I. Payload Plans and Procedures. Crewmembers will be able to display on-board payload/experiment plans and procedures and interact with the POIC and TSCs or remote sites for modification as required.

J. Monitoring Payload Health and Status. Crewmembers will be capable of monitoring payload/experiment health and status information and coordinating with the POIC and TSCs or remote sites with the results.

K. Payload Digital, Video, and Photographic Interactions. Crewmembers will be able to interact with on-board payload/experiment digital, video, and photographic data and provide the necessary interactions with the POIC and the TSCs or remote sites.

L. Recording of Payload Data. Crewmembers will be capable of recording payload/experiment data and coordinating with the POIC and TSCs or remote sites on this data as required.

M. Stowage. Crewmembers will be capable of stowing and destowing payloads/experiments and payload/experiment samples as required and coordinating with the POIC and TSCs or remote sites as required. Crewmembers should be capable of accessing and modifying the on-board stowage via the Inventory Management System (IMS).

N. Payload and LSE Transfer. Crewmembers will be capable of properly and safely transferring payloads/experiments, payload/experiment samples, and associated payload/experiment equipment (including LSE) from the transport vehicle to the correct location in the ISS (or vice versa) and correctly installing and verifying them as required.

O. Payload and LSE Transport. Crewmembers will be capable of meeting any special requirements inherent to transporting payloads/experiments, payload/experiment samples, and associated payload/experiment equipment (including LSE) aboard the transport vehicle.

P. Payload Commanding. Crewmembers will be capable of sending commands on board the ISS and be aware of ground payload commanding requirements and

capabilities. Crewmembers will also be capable of executing file transfer actions and be aware of ground activities involved in the file transfer process.

Q. Payload Control Centers Operations. Crewmembers will be generally aware of POIC payload operations procedures.

R. Payload Data Archiving. Crewmembers will be generally aware of the payload/experiment data archiving occurring in the POIC and TSCs or remote sites.

SECTION 2, DOCUMENTS

2.1 APPLICABLE DOCUMENTS

The following documents may include specifications, standards, guidelines, procedures, handbooks, and other special publications. These documents, of the exact issue shown, form a part of these requirements to the extent specified herein. Unless the exact issue and date are identified, the "Current Issue" cited in the contract Applicable Documents List applies. Inclusion of applicable documents herein does not in any way supersede the contractual order or precedence.

JSC-36307	NASA Training Implementation Plan
SSP 50200-07	Station Program Implementation Plan, Volume 7: Training
SSP 41184-01	Multilateral Training Management Plan, Volume 1
SSP 41184-02	Multilateral Training Management Plan, Volume 2

2.2 REFERENCE DOCUMENTS

The following documents are referenced in this document. Because documentation is constantly changing and evolving in the ISS Program, applicable web sites are included on this list. Additional documentation may be found there that is pertinent to crew payload training.

D683-35473-1	Payload Data Library User's Guide
D683-430-39-1	Payload Simulations Guidelines Document
JSC-28713	Space Station Mockup and Trainer Facility Payload Interface Control Document for the Payload Development Laboratory, Flight Crew Support Laboratory, and Centrifuge Accommodation Module
K-CM-05.3.2-BL	Guide for Space Station Processing at KSC

MSFC Payload Training Page	http://payloads.msfc.nasa.gov/station/train/welcome.html
No Number	Payload Training Lesson Plan (Blank Book)
POIC Documents Page	http://payloads.msfc.nasa.gov/ station/external/doc$iss.html
SSP 50253	Operations Data File Standards
SSP 50254	Operations Nomenclature
SSP 50313	Display and Graphics Commonality Standards
SSP 50323	Payload User Development Guide for the Space Station Training Facility Payload Training Capability
SSP 50503	ISS On-Board Training Media Requirements
SSP 52000-EIA-ERP	EXPRESS Integration Agreement Blank Book for Pressurized Payloads
SSP 52000-PDS	Payload Data Sets Blank Book
SSP 52000-PIA-PRP	Payload Integration Agreement Blank Book for Pressurized Payloads
SSP 58026-01	Generic Payload Simulator Requirements Document, Volume 1
SSP 58304	Payload GSP Training and Certification Plan
SSP 58700	U.S. Payload Operations Data File Management Plan and Annexes
TBD	Multilateral Advanced Training Plan (Blank Book)
TBD	Multilateral Increment Training Plan (Blank Book)
TBD	Payload Simulator Requirements Document, Volume 2

2.3 PAYLOAD TRAINING DOCUMENTATION

The remainder of this section will provide short descriptions of documentation and databases which levy requirements upon or contain information pertaining to payload or experiment training for the ISS Program. Descriptions of documentation will be relative to the payload/experiment training content of the document or data base. Figure 2-1 illustrates how the payload training documentation defined in this section relates to other payload training documents, products, and tasks. The summary of payload training documentation provided in this section is intended to be helpful in understanding the payload training process flow described in the upcoming sections.

2.3.1 General

The documents in this section are relevant to payload training, but are more general in their subject matter.

2.3.1.1 Station Program Implementation Plan, Volume 1: Station Program Management Plan

This Station Program Implementation Plan (SPIP) volume defines the implementation structure for ISS Program functions and documents the flowdown of detailed implementation. The main volume contains multilateral ISS Program processes.

2.3.1.2 Station Program Implementation Plan, Volume 7: Training

This SPIP volume defines the integration, management, and implementation tasks required of each Partner for training the flight crews and GSP. Payload or experiment training processes and tasks shall be in agreement with the contents of the SPIP, Volume 7.

2.3.1.3 Payload Integration Agreement Blank Book

The Payload Integration Agreement (PIA) blank book is a JSC document written for facility class payloads. The PD and the Payload Integration Manager (PIM) use this book for the development of a payload-unique PIA. All PIA information is entered into the appropriate data set in the Payload Data Library (PDL).

2.3.1.4 EXPRESS Integration Agreement Blank Book

The EXPRESS Integration Agreement (EIA) blank book is a MSFC document written for EXPRESS Rack payloads or experiments. The PD and the EXPRESS Payload

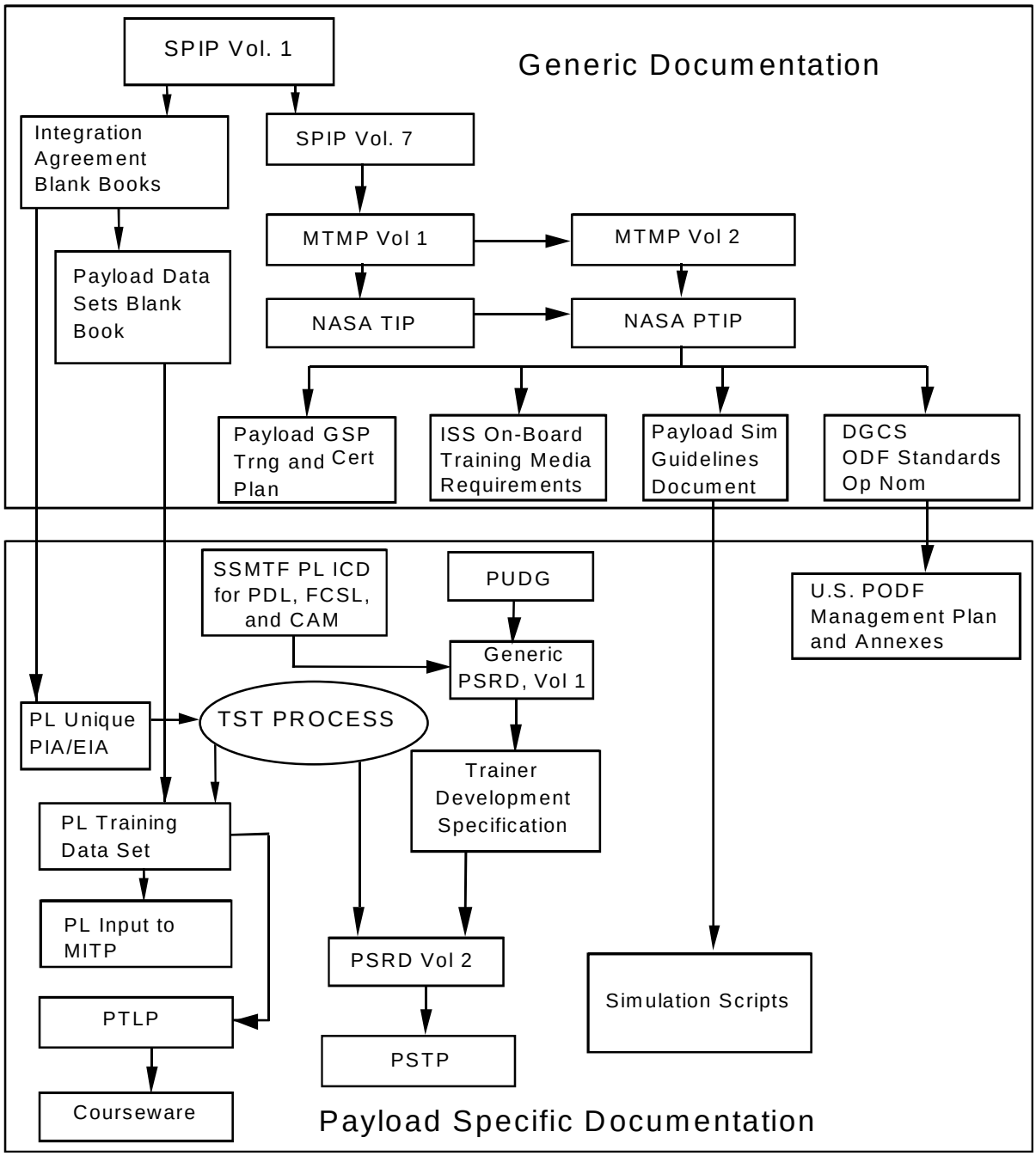


FIGURE 2-1 PAYLOAD TRAINING DOCUMENTATION TREE

Integration Manager (E-PIM) use this book for the development of a payload-unique EIA. All EIA information is entered into the appropriate data set in the PDL.

2.3.1.5 Payload Data Sets Blank Book

This JSC document controls the framework of the various data sets in the PDL. In addition, the blank book serves as a guide to users on how to use the PDL.

2.3.1.6 Multilateral Training Management Plan, Volume 1

The Multilateral Training Management Plan (MTMP), Volume 1, details training management information for the ISS Program in general, and the training community in particular. This document, developed by JSC personnel, includes the methods used for determining Program-wide standards and commonality for training-related hardware, software, and courseware.

2.3.1.7 Multilateral Training Management Plan, Volume 2, Payloads

The MTMP, Volume 2 (Payloads), supplements the MTMP, Volume 1. The document details processes and guidelines for multilateral payload training development and implementation. This document will not define processes and activities which are internal to a particular Partner. It is written by MSFC personnel. Both of the MTMP documents are Partner-oriented.

2.3.1.8 NASA Training Implementation Plan

The NASA Training Implementation Plan (NTIP) focuses on training operations for all NASA training facilities at JSC, and details the implementation of ISS training operations for crewmembers, flight controllers, and instructors. This document is developed by JSC.

2.3.1.9 Payload GSP Training and Certification Plan

The Payload GSP Training and Certification Plan defines the training and certification requirements for all POIF cadre members as well as science teams who interface with the POIC to perform ground operations of science experiments on the ISS. The plan includes course synopsis, curriculum and training flows for all team members. This plan is written by MSFC Payload GSP Training Coordinators and baselined by the NPOCB.

2.3.1.10 Payload Simulations Guidelines Document

The Payload Simulations Guidelines Document defines the personnel, processes, and tasks involved in the planning and execution of Payload-Only Simulations for the ISS. The document describes the various types of Payload-Only Simulations including generic objectives, potential trainees, and timeframes for execution. Simulation facilities and interfaces between facilities will be described. Requirements for pre-simulation checkouts, realtime simulation operations, and post-simulation debriefs will be detailed. This document will be developed and maintained by MSFC personnel.

2.3.1.11 Display and Graphics Commonality Standards

The Display and Graphics Commonality Standards (DGCS) is a JSC document that specifies standards and guidelines to be used in the development of all on-board and ground control displays. The document establishes the single source of top level, graphical, and nomenclature related standards on displays to be used in all phases of development for on-board crew displays, reference drawings, and other graphical reference material. The Integrated Display and Graphical Standards (IDAGS) Panel is responsible for the contents of this document.

2.3.1.12 Operations Data File Standards and Operation Nomenclature

Both of these documents are written and maintained by JSC personnel and controlled by the Operations Data File Control Board (ODFCB). The ODF Standards document defines the formats and conventions used in producing ODF procedures. The OpNom documents methods for denoting common nomenclature for all hardware, software, and associated data referenced by operations products produced by the ISS operations community.

2.3.1.13 ISS On-Board Training Media Requirements

This document applies to all on-board training planned for any increment crews. Specifically, the document levies the requirements everyone must adhere to concerning ISS on-board training methodology and media.

2.3.2 Payload Specific

The documents in this section specifically apply to payload or experiment training. It is noted in each description who will be responsible for writing the document or filling in information in the database.

2.3.2.1 Payload Training Data Set

A payload training data set will be created by the PD for each ISS payload or experiment. The payload training data set will be developed for the initial flight of the payload or experiment and updated to accommodate changes in the payload or experiment for future flights. Any agreements between the PD and the ISS Program concerning PD-provided simulator hardware/software necessary for crew payload training will be documented in the payload-unique PIA or EIA which are in the Integration Agreement data set in PDL.

PDs will provide training requirements for their payloads or experiments. The Simulation Engineer (SE) and PD will work together to baseline the information in the data set to correctly identify payload/experiment training requirements for a particular payload or experiment. The Payload Training Integrator (PTI) will also utilize this information for determining both individual and integrated payload training requirements for the entire payload complement. The payload training data set for a U.S. payload or experiment will consist of, but not be limited to, the following information:

A. Contact information for crew training, training units, PD team training, baseline data collection, and human use protocol.

B. Answers to general questions regarding training.

C. Training unit identification.

D. Customer courseware deliverable dates.

E. Definition of the curriculum for crew training on the payload or experiment, including session number, session hours, course objectives, timeframe, currency requirement, On-Board Training (OBT) requirement, location, instructor, method, medium, prerequisites, proficiency level, and training unit utilized.

F. Requirements for Baseline Data Collection (BDC).

G. PD GSP to be trained.

All U.S. PDs will provide their payload training data set to the ISS Program utilizing the PDL software provided by NASA. Portions of this data set will be baselined at different times. All crew training data will be baselined at Increment minus (I-)12, and all GSP training data will be baselined at I-3. Further information about the PDL is provided in the following section.

2.3.2.2 Payload Data Library

The PDL is an on-line, integrated, payload data information system used for the collection, processing, management, and distribution of payload or experiment data. The PDL is where the payload training data set for each payload or experiment, as identified in the previous section, will be collected and maintained. The PIAs and EIAs also reside in PDL in the Integration Agreement data set.

The PDL software may be accessed by first submitting a User Account Request form found on the PDL Home Page on the World Wide Web (WWW) at http://pdl.hosc.msfc.nasa.gov. Once an account is received, the PDL client software may be downloaded. See the PDL Home Page for more detailed information on platform requirements.

The PDL User's Guide, D683-35473-1, and the PDL Data Set Blank Book, SSP 52000-PDS, provide more information on how to use the PDL.

The PDL Help Line phone number is (256) 961-1265, and the PDL Fax Line is (256) 544-7960.

2.3.2.3 Multilateral Increment Training Plan

The MITP details all the training activities planned for an increment. This JSC document contains training agreements for all systems and payload training for all segments of the ISS. It includes requirements for ISS crew training. The document is published multiple times as information becomes more mature. The ITI publishes a Basic MITP at I-19 and an Update at I-12.

2.3.2.4 Payload User Development Guide

The Payload User Development Guide (PUDG) describes the Space Station Training Facility (SSTF)/Payload Training Capability (PTC) services and resources that support payload operations training. This document provides information and interface definitions required to develop a Payload Training Unit (PTU) for integration into the SSTF/PTC. The document is developed and maintained under the direction of the NASA JSC SSTF Project Office (hereafter called DV4) at JSC.

2.3.2.5 Generic Payload Simulator Requirements Document, Volume 1

The Generic Payload Simulator Requirements Document (PSRD), Volume 1, defines the functional and interface requirements for any PTU that will be used at JSC for training. The first six sections are generic and apply to all PTUs. The appendices define the specific

requirements depending on whether the PTU is an Integrated Rack, Integrated EXPRESS Sub-Rack, Stand-Alone, EXPRESS Pallet, EXPRESS Pallet Payload, or Attached Payload. The Generic PSRD has been developed by MSFC personnel.

2.3.2.6 Trainer Development Specification

A trainer development specification shall be provided by the PD as part of their payload or experiment PDR and CDR packages. The type of PTU the PD will supply for training determines which appendix the PD must comply with in the Generic PSRD, Volume 1. The Trainer Development Specification defines how the PTU will meet the requirements in the respective appendix.

2.3.2.7 Payload Simulator Requirements Document, Volume 2

The PSRD, Volume 2, defines information required by JSC personnel for integration of the PTU into a facility. Written by an SE with assistance from the PD, this volume details PD and JSC provided components; LSE, Station Support Equipment (SSE), and unique 1-g support requirements; trainer configuration/layout; and Payload Resource Utilization (PRU) data. Specific to integrated PTUs, this document provides Instructor/Operator Station (IOS) display requirements, malfunction descriptions and flags, and input/output (I/O) data maps.

2.3.2.8 Payload Simulator Test Procedure

The Payload Simulator Test Procedure (PSTP) defines the detailed acceptance tests that will be performed on all PTUs. The PSTP will be written by the SE, with assistance from the PD, as required.

2.3.2.9 Payload Training Lesson Plan

A Payload Training Lesson Plan (PTLP) defines the training sessions required to train an ISS crewmember on a particular payload or experiment. The PTLP for a specific payload or experiment should be developed to reflect all of the lessons which must be implemented to complete the training curriculum identified for that payload or experiment. Descriptions of each lesson should include objectives of the lesson, curriculum content, identification of trainees and instructors, training location and medium, lesson duration, lesson synopsis, required prerequisites, and currency requirements. Further details such as classroom presentation outlines and hands-on training scripts may also be included as applicable. Outlines and scripts allow the lesson plan to be used by any Payload Instructor for preparing and conducting actual crew training sessions. As a guideline, a generic PTLP blank book is available in the documents section on the WWW at:
http://payload.msfc.nasa.gov/station/train/ generic.html.

The PD will be responsible for the development of a PTLP any time the PD is the instructor; otherwise, the SE will develop the PTLP. Any courseware defined in the PTLP (i.e., viewgraph slides, electronic presentations) will be developed by the PD. The SE will review the PTLP and courseware prior to the payload training dry run.

2.3.2.10 Simulation Scripts

All payload simulation scripts will be developed and written by the MSFC simulation team in coordination with the Payload Instructors and PDs. The simulation working groups that PDs support are where payload-specific objectives for the scripts will be formulated and discussed prior to the writing of scripts.

2.3.2.11 U.S. Payload Operations Data File Management Plan

MSFC personnel write and maintain this plan which documents the guidelines and processes for all U.S. PODF related activities. NOTE: The plan also includes the following annexes: Annex 1 – U.S. PODF Definition; Annex 2 – Configuration Control; Annex 3 – U.S. PODF Procedure Verification and Validation; Annex 4 – Preparation and Publication Plan; Annex 5 – Payload Display Implementation Plan; and Annex 6 – Payload Display Developers Guide. This management plan, including the annexes, is especially important to PDs as it defines not only the PODF organization processes, and requirements but also how the Payload Display Review Panel (PDRP) functions and is involved in display approval and usability testing.

2.3.2.12 Space Station Mockup and Trainer Facility (SSMTF) Payload Interface Control Document (ICD) for the Payload Development Laboratory (PDL), Flight Crew Support Laboratory (FCSL), and Centrifuge Accommodation Module (CAM)

The SSMTF payload ICD for the PDL, FCSL, and CAM is written by personnel at JSC. This document applies to the general operating procedures of the PDL, FCSL, and the CAM within the SSMTF. Presently, this is the only document which specifies and controls the design interfaces for the various labs and modules within the SSMTF. Defined in the document are all mechanical, electrical, and facility interfaces as well as different services available for the PDL, FCSL, and CAM.

SECTION 3, PAYLOAD TRAINING IMPLEMENTATION TEAM

Payload training for the ISS Program will offer many challenges to both NASA and PD training organizations. Because training tools will constantly be developed and upgraded, extra care must be taken to ensure appropriate training is planned and provided, the proper tools and courseware are available for training, tracking of certification is consistent, and lessons learned are incorporated into follow-on training activities. This payload training implementation section defines the people it will take to ensure payload training will be conducted effectively and in a timely manner. The following list of basic concepts reflects how the ISS Program will approach these unique challenges:

A. Centralization of Crew Training. Training of the crew on payloads or experiments will be centralized at JSC. Any payload or experiment requiring specialized skills that can only be trained at a PDC will have to be identified by the PD during the Training Strategy Team (TST) process. A waiver will have to be justified to and approved by the JSC Payload Control Board (PCB) prior to the start of crew payload training at any PDC.

B. Payload Control Centers Operations. PDs will use their own methodology to train their own GSP on the operations required in each of their ground support facilities. MSFC will provide GSP training on the interfaces between POIC personnel and science teams. NASA will also implement Payload-Only Simulations in which science teams will receive training on the interactions between their ground support facilities and the POIC.

C. Payload Training Materials. PDs will be responsible for providing payload training capabilities, equipment, courseware, and supporting materials for the crew and GSP according to ISS Program guidelines and requirements defined in SPIP, Volume 7: Training and the MTMP, Volume 1.

D. Schedules. PDs will plan to train crewmembers during a window between I-18 to I-6 unless they have a proficiency requirement. Some proficiency requirements may cause training to continue through launch. The training of GSP will follow schedules internal to PDs without regard to launch dates except for Payload-Only Simulations and JMST schedules. The PTI and Increment Training Integrator (ITI) will coordinate with PDs to schedule these joint training dates as appropriate.

E. On-board Training. PDs will provide for On-Board Training (OBT) of the crew if required. Note that this training will be scheduled against utilization time.

3.1 PAYLOAD TRAINING PLANNING PROCESS

There are many referrals throughout this document to the TST process. Briefly, this process involves a structured planning and decision-making group who determine the payload training requirements for each payload or experiment and complements of payloads or experiments. Payload training requirements, and what will be needed to fulfill those requirements, for both crewmembers and GSP, are discussed, defined, and agreed upon during this process. For more detailed information about the TST process, see Section 5.2 and Appendix C.

3.2 PAYLOAD TRAINING ROLES AND RESPONSIBILITIES

The roles and responsibilities for planning and implementing U.S. payload training can be described in general to follow these guidelines:

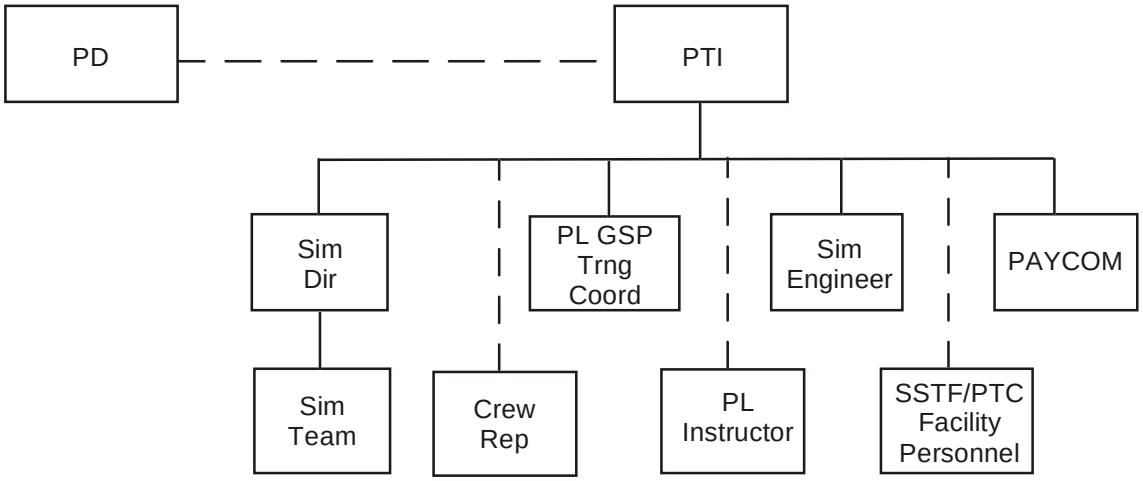
A. POIF personnel will be responsible for integrating the planning, scheduling, and implementation of payload training for U.S. payloads or experiments in coordination with the PDs and the International Training Control Board (ITCB). The ITCB/POIF will assign a PTI who will provide input for the purposes of ISS payload tactical planning and also organize TSTs during the payload training development phase. The PTI will implement the results and recommendations of the TSTs and team with the ITI for scheduling and implementation purposes. The POIF will provide guidance to PDs to ensure compliance with overall crew and GSP training and certification standards. The POIF will further provide simulation engineering guidance to PDs for the requirements definition, delivery, and verification of PTUs for crew training. The POIF will provide GSP Payload-Only Simulations to coordinate activities between POIC cadre and science team GSP, and will also support Integrated Payload-Only Simulations and JMST as required.

B. PDs will be responsible for supporting the PTI and the TST process, for training their GSP to meet training and certification standards, for providing a payload training point of contact, and for providing timely input to all POIF and PTI schedules and documentation. PDs will be responsible for implementing crewmember training on their science or technology payloads or ensuring that the training is available.

C. JSC Mission Operations Directorate (MOD) will provide a PTC for the crew at the SSTF and assist the PTI in the coordination and certification required for payload or experiment training there and at other JSC training facilities. JSC MOD will also provide Payload Instructors at JSC as required and coordinate the training and development of those instructors with the PTI. JSC MOD will also provide support for SEs in the installation, checkout, and operation of crew PTUs at JSC. Training facility procedures and/or processes will be defined and documented by this group.

This group will also coordinate facility requirements and assist in the setup of crew payload training.

The remainder of this section will describe the individual personnel involved in payload or experiment training activities for the ISS Program. Figure 3-1 shows how the payload training personnel described in this section interface with each other. Figure 3-2 shows how the entire payload training team will work together to efficiently train crewmembers and GSP increment by increment. Appendix G was finalized, agreed to, and signed by MOD and Space Flight Division (SFD) (formerly Mission Operations Laboratory (MOL)) personnel in October 1998. These matrices attempt to show where responsibilities lie in the categories of Planning, Scheduling, Development, and Implementation. Many of the responsibilities mentioned are explained more fully in sections that follow this one.



Legend:
Dashed lines denote those people that are part of the PL Training Team, but do not answer directly to the PTI.

FIGURE 3-1 PAYLOAD TRAINING TEAM INTERFACES

3.2.1 Payload Developer Training Responsibilities

A. Support the TST process and work with the SE and PTI to implement the results and recommendations of the TST.

B. Review and understand the PUDG and Generic PSRD, Volume 1.

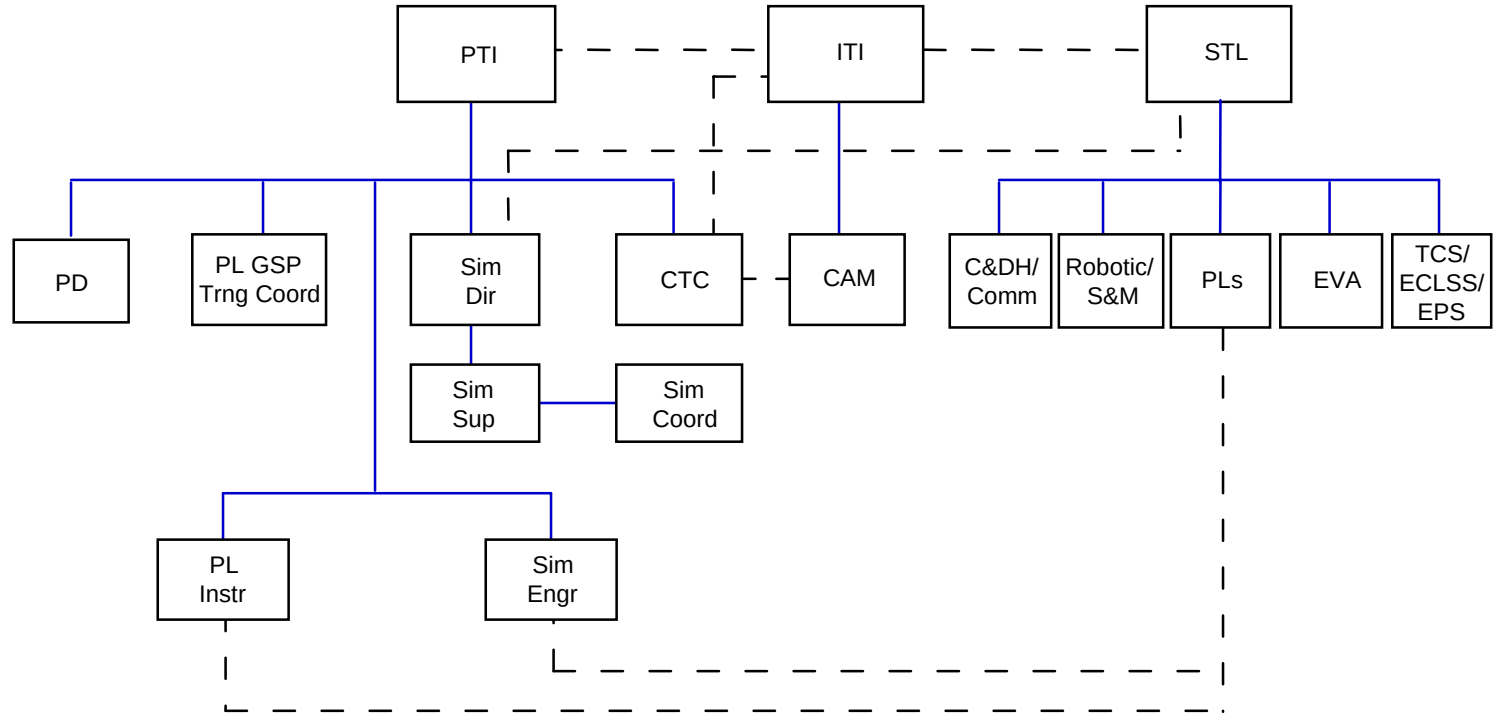


FIGURE 3-2 INCREMENT TRAINING TEAM

C. Write a Trainer Development Specification in accordance with the Generic PSRD, Volume 1.

D. Design, develop, construct, deliver, test, and install PTUs per requirements in the PUDG; Generic PSRD, Vol. 1; SSMTF Payload ICD for the PDL, FCSL, and CAM; Trainer Development Specification; and this document.

E. Maintain the payload training unit in working order while it is at JSC, and supply any spare parts required unless negotiated otherwise.

F. Develop a PTLP, provide to the SE for review, and execute a Payload Training Dry Run (PTDR) (if assigned as instructor).

G. Develop training manuals, Computer-Based Training (CBT), and/or other training materials in order to effectively conduct payload or experiment training as necessary.

H. Provide or train a Payload or Experiment Instructor.

I. Verify and validate procedures and displays internally.

J. Assure procedures and displays are approved by PODF and PDRP personnel, respectively.

K. Conduct crew payload or experiment training with a certified instructor.

L. Work PD-related action items resulting from PTDRs or training and provide SE or Payload Communications Manager (PAYCOM) with information that would assist in their closure.

M. Develop OBT materials if required.

N. Be responsible for the training of their own GSP in accordance with POIF training and certification standards as defined in the Payload GSP Training and Certification Plan.

O. Participate in both types of Payload-Only Simulations and JMST as required.

P. Populate data sets in PDL at I-20 for planning purposes and baseline the data at a later date.

Q. Coordinate internal/schedule information (such as timeframes instructors, hardware, facilities, etc., will or will not be available) with the PTI so a training activity can be planned in the correct crew rotation window.

3.2.2 Payload Training Integrator Responsibilities

The PTI will have overall management responsibility for crew and GSP payload and experiment training for a specific increment. This person will be assigned no later than I-24 with the following assigned responsibilities:

A. Provide input to the tactical planning process.

B. Conduct and chair the payload complement training portion of the TST process (TST #2).

C. Integrate ISS/Shuttle crew and GSP training requirements for a defined payload complement.

D. Provide input to the ITI for the development of the payload-specific content of the MITP and the Multilateral Advanced Training Plan (MATP).

E. Assess all payload and experiment training requirements and work an integrated plan with the ITI.

F. Coordinate development of a Long-Range Training Template with the ITI and a Detailed Crew Training Plan with the Crew Activity Manager (CAM).

G. Review inputs to PDL with PDs and implement changes when necessary.

H. Coordinate the efforts of the SEs for the purpose of developing, testing, installing, and operating PTUs at JSC.

I. Conduct and support PTDR for Payload Complement Training lessons.

J. Schedule and conduct Increment Training Readiness Review (ITRR) and Payload Complement Orientations.

K. Ensure training and certification of all Payload Instructors.

L. Management responsibility for GSP and Integrated Payload-Only Simulations.

M. Provide the ITCB, the Payload Training Panel, Flight Readiness Review groups, and other such required review groups with supporting payload training documentation.

N. Coordinate crewmember’s job assignments with the crew office and ITI.

O. Provide input to the increment Payload Operations Director (POD) to support Certificate of Flight Readiness (CoFR) for the purpose of certifying crew and GSP.

P. Maintain an Increment Level IV schedule, which is a rollup of the Increment training information, and provide increment training schedule updates to the Level III POIF schedule.

Q. Create a crew training schedule to provide to the PAYCOM for implementation.

R. Coordinate with Station Training Leads (STL) for planning and implementation of the payload complement training and to define ISS training requirements for shuttle crews.

S. Provide a consolidated Advanced payload training schedule input to the CAM for integration into the crew schedule and work with PDs and CAM to define weekly and daily schedules for Advanced training on U.S. payloads.

T. Coordinate the day-to-day crew payload or experiment training activities for each crewmember with the CAM based on the crewmember's job assignment and payload or experiment training requirements.

U. Interface with the CAM to coordinate/integrate required payload or experiment training hours into the Weekly Crew Activity Schedule.

V. Coordinate training activities with PDs, Payload Instructors, STL, and facilities personnel to prepare for training execution.

3.2.3 Payload Communications Manager Payload Responsibilities

The PAYCOM will coordinate and implement the crew payload training plan that has been defined by the PTI and SE. Three PAYCOMs will be assigned by MSFC at I-20 for a specific increment with the following assigned responsibilities:

A. Follow a specific crew set through their training flow in order to become familiar with the payload and experiment operations for the defined payload complement.

B. Ensure daily crew training payload or experiment activities are implemented by facilitating training sessions.

C. Track any action items arising during training; provide PD-related information to PD; and follow action item through to closure.

D. Maintain accurate records of training in the payload training database (trainee, course, scheduled duration, actual duration, etc.) and provide PD-related information to PD.

E. Suggest updates and modifications to payload or experiment training lesson plans when required.

F. Respond to lessons learned and ensure they are implemented in future training flows as well as provide PD-related information to PD.

G. Provide Mission Planning listing of crew training by payload or experiment for incorporation into the mission planning products and to highlight any payloads or experiments requiring training on board.

H. Serve as a member of the POIC cadre during realtime increment.

3.2.4 Increment Training Integrator Payload Responsibilities

The ITI will be responsible for integrating all training requirements across the ISS Program per increment. This person will be assigned by the JSC for a specific increment with the following payload training-related responsibilities:

A. Develop an MITP which includes crew payload or experiment training schedules and plans as derived from the payload training data set in PDL and the MATP which includes crew payload or experiment courses required during Advanced training and derived from working with the PTI.

B. Coordinate Long-Range Training Template with PTI for the purposes of implementing payload training.

C. Coordinate and support training and facility readiness reviews as they pertain to crew payload training.

D. Collect Informed Consent briefings or mandatory self-study materials in English 30 days prior to the actual training session and distribute them simultaneously to JSC personnel for translation and to Russian training personnel.

E. Distribute a detailed crew schedule 30 days prior to the actual training session.

F. Provide to Russia detailed lesson objectives for all lessons that will be trained 2 weeks before the actual training session begins.

G. Distribute to crewmembers all presentation/handout materials (either in Russian or English) 5 days prior to the actual training session.

3.2.5 Crew Activity Manager Payload Responsibilities

The CAM will be responsible for scheduling crew and facilities. This person will be assigned by the JSC for a specific increment with the following payload training-related responsibilities:

A. Work with the ITI and PTI to produce a detailed Crew Training Plan tailored to individual crewmembers prior to the beginning of crew training.

B. Provide a weekly crew activity schedule to include payload and experiment training activities as provided by the PTI.

C. Coordinate with the PTI or PAYCOM for short-term crew training schedule changes.

D. Schedule SSTF/PTC facility and resources such as LSE/SSE, flight software loads, strings required, etc., for crew training.

E. Schedule other facilities but not resources for other crew-related activities.

3.2.6 Simulation Engineer Responsibilities

An SE will be assigned by the MSFC to a payload or experiment to assist the PD and PTI. The SE will begin supporting the PD and PTI in the earliest phases of planning for payload training and will remain actively involved all the way through training implementation. This person has the following responsibilities:

A. Represent the PTI and serve as the PD point of contact for a specific payload or experiment or set of payloads or experiments for the purposes of developing, integrating, and implementing crew payload training.

B. Acting as a member of a payload training team, assist the PD in determining requirements for payload or experiment training equipment, training hours, and training curriculum during Technical Interchange Meetings (TIM) and the TST process. Also conduct and chair all TIMs and TST #1.

C. Review PDL training data set inputs with PDs.

D. Develop, implement, and keep the payload training team apprised of the Level V schedule, which is a timetable of key payload milestones for all facets of payload-/experiment-specific training equipment readiness.

E. Review and understand the PUDG.

F. Coordinate with the PD for the development, delivery, installation, and verification of their payload training unit, if applicable.

G. Act as the interface between the PD and any JSC facility for any PTU which will be brought into or integrated into that facility, if applicable.

H. Prepare the PSRD (Volume 2) and baseline document at NPOCB.

I. Write a PSTP document and conduct a pre-ship verification, a Payload Simulator Inventory and Interface Checkout (PSIIC) Phase 1, and Payload Simulator Acceptance Test (PSAT) utilizing the PSTP. See Testing paragraphs in Section 6 for further details.

J. Install or assist PD with the installation of their integrated sub-rack payloads or experiments into the rack facility and support testing, if applicable.

K. Coordinate development of the curriculum, training lesson plans, and courseware needed for training.

L. Prepare the PTLP for any payload training the SE will conduct; otherwise review PTLP and courseware from the designated Payload Instructor. Work with Payload Instructor to maintain the content of lesson plans for all increments the payload or experiment is utilized.

M. Complete Payload Instructor training and certification (when required); otherwise assist others in their completion of Payload Instructor training and certification.

N. Attend and conduct PTDRs.

O. Evaluate and certify the Payload Instructor in execution of the PTDR.

P. Review and be aware of operational hazard controls defined in Payload Hazard Reports and ensure training curriculum adequately addresses them.

Q. Ensure adequacy of training when the training serves as a hazard control and provide conclusions to PTI.

R. Conduct crew training for each payload or experiment when designated as Payload Instructor.

S. Coordinate PTU maintenance and/or modification/upgrade requirements and activities throughout the PTU’s residence at JSC.

T. Prepare a Payload Complement Requirements Checklist (PCRC) for the SSTF/PTC and perform the Payload Complement Requirements Test (PCRT) on the payload complement at the SSTF/PTC (Lead SE only).

U. Identify and utilize crew payload training materials to provide cadre training if required.

V. Conduct and/or support Payload Complement Training, Integrated Payload-Only Simulations, and JMST at the SSTF/PTC using the simulator payload complement.

W. Serve as member of the simulation team for the development, checkout, and implementation of simulations.

3.2.7 Johnson Space Center Payload Instructor Responsibilities

JSC Payload Instructors possess expertise on the hardware, software, and administrative requirements of JSC facilities. They will be assigned by JSC when required and have the following responsibilities:

A. Participate in the TST process for payloads or experiments to review the planning and development of PTU and training requirements.

B. Participate in the review and verification activities for PTUs and payload training documentation in order to become familiar with payload/experiment and PTU capabilities.

C. Receive certification by the PD and SE in order to conduct crew payload training when requested as defined in Section 7.

D. Assist the SE in identifying PTU maintenance and modification/upgrade requirements throughout the PTU's residence at JSC.

E. Assist the PDs/SEs in maintaining the content of payload or experiment training lesson plans for all increments the payload or experiment is utilized.

F. Serve as an in-house point of contact for the SE in coordinating training equipment which will be delivered to JSC but not integrated into the SSTF/PTC.

G. Assist the SE in the setup and preparation of crew training sessions and PTDR.

H. Develop IOS displays and facility operating procedures to support crew payload training.

I. Be responsible for the training of MCC ground controllers and help to ensure the proper development of products where payload-to-systems interfaces are defined and/or implemented.

J. Serve as members of the simulation team for the development, checkout, and implementation of simulations, and support as crew surrogates if required.

K. Prepare and coordinate signature approval and resolution of issues regarding Payload Lesson Change Request (PLCR).

3.2.8 SSTF/PTC Personnel Responsibilities

SSTF/PTC personnel are managed by a NASA DV4 representative at JSC. The SSTF/PTC personnel are responsible for the management and systems engineering of the SSTF/PTC which includes design, development, and sustaining engineering. These personnel have the following responsibilities:

A. Conduct SSTF/PTC facility operations.

B. Provide SSTF/PTC maintenance.

C. Develop and maintain the PUDG to provide the PD with specifications for payload or experiment simulators which interface to the SSTF/PTC.

D. Participate in the review of the Trainer Development Specification Document and PSRD, Volume 2.

E. Work directly with the PDs and SEs on the delivery, inventory, installation, integration, test, and verification of Payload Training Simulators (PTS) at the SSTF/PTC per the PUDG and applicable portions of the PSTP.

F. Test integrated rack PTUs in a Standalone Payload Training Capability (SPTC) configuration (PTS/STFx/STEP) STFx and a STEP.

G. Develop PRU models to represent the PTS (PTU) when the associated PTS (PTU) is not available for inclusion in the SSTF/PTC simulation session.

H. Provide limited maintenance functions (e.g., filter swaps, bulb replacement) for a payload simulator as documented in the individual Simulation Maintenance Procedure Document.

I. Develop, integrate, and test SSTF/PTC subsystems and system including external interfaces (voice, video, data, commanding, IOS) to MCC, JSC Bldg 8, NBL, and HOSC/POIC/RAPS.

J. Develop, integrate, and reconfigure as necessary flight training loads including flight software integration.

K. Develop PSE, STFx for PD use in PTU development and supply user guides.

L. Develop the SPTC.

3.2.9 Payload Simulation Director Responsibilities

A Payload Simulation Director will be assigned by the MSFC and oversee all payload simulations involving POIC cadre as well as TSC, remote sites, and International Partner (IP) personnel. The Payload Simulation Director will be responsible for the following:

A. Coordinate all Payload-Only Simulation Working Group (POSWG) and the Joint Multi-Segment Training Working Group (JMSTWG) meetings.

B. Serve as the lead payload training representative to JMSTWG meetings.

C. Track the closure of payload actions from POSWG and JMSTWG meetings.

D. Compile and maintain a Simulation Schedule for each increment detailing GSP/Integrated Payload-Only Simulations and payload participation in JMST activities, including script verifications and data flow test windows for each of these activities.

E. Coordinate simulation schedules, notification of all involved personnel, and scheduling of pre-simulation (sim) and post-sim briefings.

F. Work with the POIC cadre and the Payload Simulation Coordinator to provide surrogates for simulations when needed.

G. Coordinate with the Increment Simulation Supervisor to solve sim-related problems during simulation planning, coordination, and execution.

H. Oversee simulation debriefs and closure of all actions from these debriefs.

I. Evaluate the GSP Payload-Only Simulations, Integrated Payload-Only Simulations, and JMST scripts and training objectives to make sure they meet the requirements defined during the TST process.

J. Coordinate with the Increment Simulation Supervisor, STL, and training representatives from TSCs, remote sites, and IPs for planning, developing, coordinating, and implementing Integrated Payload-Only Simulations and payload participation in JMST.

K. Develop and verify cadre-specific simulation scenarios, cases and malfunctions or events.

3.2.10 Increment Simulation Supervisor Responsibilities

An Increment Simulation Supervisor will be assigned by the MSFC to work with the Payload Simulation Director in simulation implementation. The Increment Simulation Supervisor will be responsible for the following:

A. Conduct all POSWG meetings.

B. Plan, develop, coordinate, and implement GSP Payload-Only Simulations scripts.

C. Ensure the development of simulation scripts and all supporting data for Payload-Only Simulations.

D. Identify and coordinate facility, systems, and personnel requirements for simulation support for GSP Payload-Only Simulations.

E. Provide direction to the payload simulation team during realtime simulation activities.

F. Coordinate with the Payload Simulation Director, STL, and training representatives from TSCs, remote sites, and IPs for planning, developing, coordinating, and implementing Integrated Payload-Only Simulations and payload participation in JMST.

G. Ensure the development and incorporation of payload script inputs and payload supporting data for JMST.

H. Identify and coordinate for Integrated Payload-Only Simulations and JMST the facility, systems, and personnel required to interface to JSC, TSCs, remote sites, and IP centers.

I. Coordinate with the participating simulation teams during execution of JMST.

J. Develop and verify cadre-specific simulation scenarios, cases and malfunctions or events.

3.2.11 Payload Simulation Coordinator Responsibilities

A Payload Simulation Coordinator will be assigned by the MSFC to work with the Payload Simulation Director and Increment Simulation Supervisor in simulation implementation. The Payload Simulation Coordinator will be responsible for the following:

A. Assist the Increment Simulation Supervisor in the development and verification of the simulation scripts, simulation data flows, and support facility readiness.

B. Define simulation events involving payloads or experiments.

C. Assist in conducting the simulations.

D. Coordinate all pre-planned script inputs and implement/coordinate any realtime changes directed by the Increment Simulation Supervisor.

E. Work with the Payload Simulation Director to provide surrogates for simulations when needed.

F. Develop and verify cadre-specific simulation scenarios, cases and malfunctions or events.

G. Develop and conduct surrogate training classes for GSP/Integrated Payload-Only Simulations.

3.2.12 Station Training Lead Payload Responsibilities

An STL will be assigned by JSC. The STL will be responsible for the planning and execution of all “team training” at JSC. STL responsibilities related to payload training are:

A. Coordinate with the PTI for the planning and implementation of Payload Complement training.

B. Work with the Payload Simulation Director in defining objectives and hours for payload participation in JMST.

C. Coordinate with the Payload Simulation Director for the planning and implementation of Integrated Payload-Only Simulations and payload participation in JMST.

D. Be involved in those portions of the TST process where objectives and hours for the above-mentioned types of training are defined.

E. Participate in POSWG meetings when Integrated Payload-Only Simulations are being worked and be involved in the development of simulation scripts and products to support the Integrated Payload-Only Simulations.

F. Participate in all JMSTWG meetings to assist in the development of payload or experiment script inputs and payload products for JMST. Overall coordination and execution of the JMST will be the responsibility of the STL.

G. Interface with the Payload Simulation Director and Increment Simulation Supervisor to ensure that payload training objectives are accomplished.

H. Work with the Payload Simulation Director to schedule and conduct verifications for both Integrated Payload-Only Simulations and JMST where payloads or experiments participate.

I. Work with each Training Manager assigned to a flight, ITI, and PTI to define the ISS training requirements required for Shuttle crews.

3.2.13 Payload GSP Training Coordinator Responsibilities

Payload GSP Training Coordinators will be assigned by the MSFC and will be responsible for the overall administration of GSP training. The responsibilities listed below are for the Payload GSP Training Coordinators resident at MSFC. All PD GSP training requirements and responsibilities are documented in the Payload Training and Certification Plan.

A. Develop and maintain the Payload GSP Training and Certification Plan.

B. Develop and maintain a GSP Training Schedule for each increment.

C. Develop and maintain a GSP Training Matrix for each increment to identify the training curriculum requirements and training completed for each trainee.

D. Oversee the development, scheduling, and implementation of training to GSP and track the progress of trainees.

E. Provide training reports to increment leads, managers, and trainees.

F. Maintain a training library of all training material.

3.2.14 Ground Training Integrator

Ground Training Integrators (GTI) will be assigned by the MSFC and will be responsible for the overall requirements and implementation of GSP training. The responsibilities listed below are for the GTIs resident at MSFC. All PD GSP training requirements and responsibilities are documented in the Payload Training and Certification Plan.

A. Receive GSP training requirements.

B. Develop and maintain the Payload GSP Training and Certification Plan with the Payload GSP Training Coordinator.

C. Manage the implementation of the GSP Training and Certification Plan.

D. Oversee the development, configuration management, and maintenance of MSFC-provided payload GSP courses.

E. Chair the applicable TST#2 TIMs.

F. Other duties

3.2.15 Crew Payload Responsibilities

The following responsibilities can be fulfilled either by a crewmember or a crew representative:

A. Participate in all phases of planning, development, and execution for payload or experiment training.

B. Participate in the TST process to assist in the development of payload or experiment training requirements for individual payloads or experiments and payload complements.

C. Participate in the PTDR and certify lessons/Payload Instructors are ready for crew payload or experiment training.

D. Participate in all aspects of payload training implementation including PDC training (if necessary) and training at the SSTF/PTC, SSMTF, and OBT.

3.3 PAYLOAD OPERATIONS DESCRIPTIONS

In order to define and implement valid payload training requirements, POIC personnel and science teams need to analyze the functions that must be performed on board and on the ground to support payload or experiment operations. This section will provide a standard set of payload task descriptions to be used in defining payload training requirements for both crew and GSP. Using these basic task descriptions, payload training programs can then be designed to be relevant to the payload or experiment tasks that must be performed. Crew, science teams, and POIC cadre functions are provided in Tables 3-I, 3-II, and 3-III, respectively. Note that these tables are intended to outline possible functions that should be considered when performing payload or experiment operations. These tables are not intended to define specific personnel or team structures.

TABLE 3-I CREW PAYLOAD FUNCTIONS

FUNCTION	DESCRIPTION
Payload Generic Operations	Understand payload or experiment science only as necessary for awareness as well as generic safety hazards presented by payloads or experiments. The job also includes skill-based training of emergencies.
Payload Primary Operations	Perform all payload or experiment operations for a given payload or experiment while on board the ISS. The job includes, but is not limited to, activation and checkout, nominal operations, maintenance operations, malfunction operations, hazard recognition and safing, and deactivation.
Payload Backup Operations	Perform nominal operations, safing and emergency procedures, and hazard recognition for a given payload or experiment.
Payload Subject Operations	Participate in payload or experiment operations as a scientific subject. Prime and backup fully trained as nominal operators and subjects to include hazard recognition and emergency procedures. All other subjects provided with minimal level of subject training.
Payload Transport Operations	Perform all payload or experiment operations for a given payload or experiment while on board the transport vehicle. The job includes nominal operations, maintenance operations, and malfunction operations.
Payload Transfer Operations	Perform all payload or experiment transfer operations for a given payload or experiment. The job includes transfer and outfitting of all equipment for a given payload or experiment.

TABLE 3-II SCIENCE TEAM FUNCTIONS

FUNCTION	DESCRIPTION
Payload Data/Engineering	Monitoring payload/experiment health and status data, identifying off-nominal indications of payload/experiment components, troubleshooting and resolution of payload/experiment equipment anomalies.
Payload Commanding	Building and sending payload/experiment command data. Monitoring command feedback, link, and windows. Troubleshooting and resolution of commanding anomalies.
Payload S/G Coordination	Monitoring and documenting payload/experiment S/G traffic.
Payload Operations Lead	Tracking realtime on-board and ground payload/experiment operations to ensure proper resource allocations and synchronization, verify equipment configurations and readiness, and coordinate personnel.
Payload Scientist	Monitoring payload/experiment scientific data and modifying parameters to maximize scientific return.
Payload Data Archiving	Storing and archiving downlinked payload/experiment digital, video, and voice data.
Payload Systems and LSE/SSE Interfaces	Monitoring systems supporting payload/experiment operations, identifying off-nominal systems indications and payload/experiment impacts, troubleshooting and resolution of system anomalies affecting payloads/experiments. Coordinating and tracking payload/experiment usage of LSE/SSE.
Payload Planning	Identifying resources and defining plans for future payload/experiment operations.
Payload Stowage	Tracking payload/experiment stowage locations, consumables, and trash management.

TABLE 3-III POIC CADRE FUNCTIONS

FUNCTION	DESCRIPTION
Payload Operations Management	Direction of payload operations. Primary interface with ISS payload operations management.
Ground Configuration Management	Coordination of ground-based systems to include networks, data bases, and facilities.
Payload Communications	S/G coordination for payload/experiment operations.
Timeline Management	Coordination of payload timeline products update and execution. Monitoring U.S. resources. Generation of daily plans and resources for U.S. payloads/experiments. Primary interface to weekly planning function.
On-board Configuration Management	Coordination of on-board files, payload support systems, payload/experiment downlink, and payload/experiment safety considerations for U.S. Lab.
International Partner (IP) On-board Configuration Coordination	Coordination of U.S. payload/experiment operations and systems in IP Labs.
Weekly Planning	Coordination and integration of resources and products for weekly payload plans.
Stowage	Coordination of stowage locations, consumables, and trash management.

SECTION 4, PAYLOAD TRAINING ANALYSIS, PLANNING, AND IMPLEMENTATION

Payload training for the ISS Program is organized for an ever-changing payload complement on orbit over the lifetime of the Station. The crewmembers who operate these payload complements will also be changing, and their duties and training emphasis may change as they progress through the assembly phase to the steady-state operations phase. The ISS Program crewmembers will also be launched from different sites, will stay on orbit for variable times, and their numbers may well grow as the Station capability to support them increases. Similarly, there will be a mix of changing GSP with their own set of variables supporting the various complements. All of these aspects of the ISS Program must be accounted for in planning and implementing payload training. The following sections describe the analysis, planning, and implementation that must take place for efficient payload training.

4.1 TRAINING EQUIPMENT

The PD will be responsible for providing equipment to meet the experiment requirements for training of the crew and the GSP on the scientific and operational aspects of their payload or experiment. The SE will be available to the PDs to assist in defining the training equipment required using the payload classification process and training fidelity requirements provided below. Appendix D provides a description of the simulator fidelities. The SE will ensure that the decisions in the flow and the resulting classification are consistent from payload to payload or experiment to experiment and will result in training equipment capable of meeting the program's training needs for the crew and the GSP.

4.1.1 Payload Classification for Training

A classification system for payload or experiment training has been devised for top-level determination of training equipment requirements, allowing the PD to plan for this equipment at an early phase of the program. This classification system can be used by PDs at any time during the evolution of their payload or experiment to assist with projecting budgets and schedules for the training aspect of their ISS payload or experiment. Any payload or experiment, whether it consists of a multi-rack facility, an EXPRESS-mounted drawer, or LSE, will be classified according to the flow provided in Figure 4-1 to define the training equipment required to fulfill its training objectives. This classification flow uses criteria involving the complexity of the payload's or experiment's crew interfaces, which in turn drives the complexity of the payload's or experiment's training objectives and the type of trainers required. The emphasis is placed upon training tools to take into account the need for centralized crew training and rigid crew travel constraints while still providing

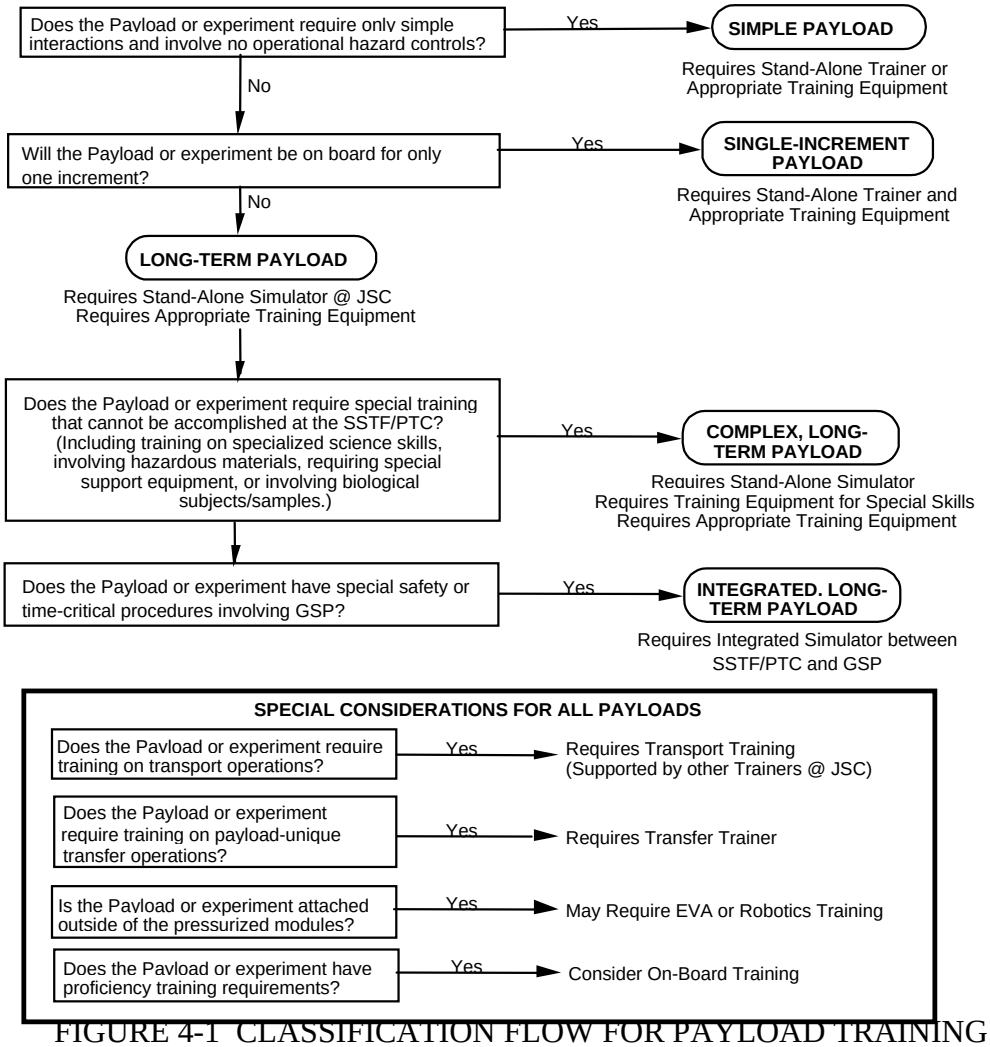


FIGURE 4-1 CLASSIFICATION FLOW FOR PAYLOAD TRAINING

comprehensive training capabilities for crew and GSP. Using this system, a payload or experiment will be placed into one of five payload training classifications: Simple Payload, Single-Increment Payload, Long-Term Payload, Complex Long-Term Payload and Integrated Long-Term Payload. Each classification is then tied to a general concept for training as well as a set of Program-imposed requirements for training. Note that the TST process, described in Section 5.2, will then consider each payload or experiment individually to refine the

Program-imposed requirements and determine what is “smart” for a particular payload or experiment.

The following paragraphs provide information about the classification flow, including the criteria for each classification and the requirements imposed on payloads or experiments in each classification. The detailed requirements for the training equipment derived from this process are provided in the next section.

4.1.1.1 Simple Payloads

Simple Payloads are those payloads or experiments with minimal crew interaction which do not involve potentially hazardous operations or safety hazards. Crew activities would require either simple activation/deactivation or no interaction at all.

Payloads or experiments that fit into this classification will be labeled as Simple Payloads, and, because of their limited crew training requirements, PDs will only be required to provide a stand-alone trainer or other appropriate training equipment (such as a CBT). For payloads or experiments that require no crew interaction (only training required is for background science awareness and general overview of the payload or experiment), less expensive types of portable trainers, such as video tapes or training manuals, will be sufficient.

4.1.1.2 Single-Increment Payloads

The Single-Increment Payload classification was created for those payloads or experiments that will be on board for only a single increment; thus, training would only be provided to a limited number of crewmembers. For this reason, requiring the PD to provide specially built trainers or PTUs was not justified. This is not meant to minimize the PD’s responsibility to provide adequate training, only to allow that training be provided with equipment built for multiple purposes, such as existing training equipment, engineering mockups, or other ground test equipment.

Payloads or experiments that fit into this classification will be required to provide a stand-alone trainer and/or other appropriate training equipment. Note that if a payload or experiment is classified as Single-Increment, it could require operational hazard controls or require complex crew interactions; thus, a stand-alone trainer or training equipment will be required to provide the training fidelity necessary to train the crew and GSP on payload or experiment operations.

4.1.1.3 Long-Term Payloads

Payloads or experiments that do not fit the Simple or Single-Increment classifications will be classified as Long-Term Payloads. These payloads or experiments will be on board for multiple increments and may or may not involve extensive crew interactions or hazardous operations. Long-Term Payloads will be required to provide a Stand-Alone Trainer for crew training at JSC. It is preferred that this trainer be located at the SSTF/PTC unless special facility requirements dictate otherwise. If located at the SSTF/PTC, Facility Class payloads or EXPRESS Racks will be required to physically fit within the U.S. Lab/SLAB and must accommodate the physical interface of sub-rack payloads or experiments. Sub-rack payloads or experiments must physically interface within the host rack. (NOTE: Existing training hardware will not need to be modified to physically interface within the host rack.)

Long-Term Payloads may also be required to provide portable training equipment for conducting proficiency, refresher, and on-board training. This capability will be used in the event that crew access to simulators during final months prior to launch is prevented, for example if crewmembers are in Russia for a Soyuz launch. This capability could also be used to provide training for GSP who do not have access to the integrated simulator in the SSTF/PTC.

4.1.1.4 Complex Long-Term Payloads

The Complex classification is for Long-Term Payloads that will also require special training involving specialized science skills, hazardous materials, special support equipment, or biological subjects/samples. These payloads or experiments will require specialized training equipment in addition to the Long-Term Payload requirements in order to fulfill their training objectives for special skills. This specialized training equipment will be provided for crew training at JSC to the extent possible, but waivers could be granted if training at a PDC is deemed absolutely necessary.

4.1.1.5 Integrated Long-Term Payloads

The Integrated classification is for Long-Term Payloads that will require special safety or time-critical procedures involving GSP. If training requirements exist for the crew to use payload PCS displays, an integrated simulator will be considered by the TST if the requirements cannot be met by a stand-alone simulator. If the payload consists of a full ISPR, e.g., facilities or EXPRESS Racks, the integrated simulator will interface directly with the SSTF/PTC. For EXPRESS or other sub-rack payloads or experiments, the integrated simulator will interface with the host rack, which in turn provides the SSTF/PTC interface.

4.1.1.6 Special Considerations for All Payloads

A. Transport Training. Payloads or experiments requiring crew support during ascent or descent will be required to provide transport training to the transport vehicle's crew. This training, in most cases, does not require a separate PTU. The stand-alone trainer or integrated simulator planned to support ISS crew training should also be designed to support transport training.

B. Transfer Training. Crews must be trained on the transfer of payload or experiment hardware between the transport vehicle and the ISS. Training on the transfer of whole racks or generic sub-rack elements (e.g., standard lockers and drawers) will be provided by the ISS program. Transfer training on payload/experiment-unique handling or interfaces will require the PD to develop lightweight mockups with the appropriate high-fidelity physical interfaces. Training on payload/experiment-unique operations requiring functional fidelity will be supported by the stand-alone trainer or integrated simulator.

C. EVA or Robotics Training. Attached payloads or experiments will be required to provide data to support Extravehicular Activity (EVA) training (if EVA installation or servicing is planned) and robotics training (for manipulation of the payload/experiment with the Remote Manipulator System (RMS) or Shuttle Remote Manipulator System (SRMS)) as determined by the TST. The Neutral Buoyancy Laboratory (NBL) and Multi-use Remote Manipulator Development Facility (MRMDF) will provide a generic suite of mockups to support this training. The PDs will not be required to build mockups unless their payload or experiment is volumetrically unique or has unique interfaces. The PD will provide payload/experiment envelope size, shape, and crew interfaces; mass; and center-of-gravity data to the NASA training personnel through PDL to support development of these trainers. The PD will coordinate with MOD personnel as specified in the NTIP and the NBL Guide for unique mockups in the NBL. JSC-DX will write the requirements for unique balloon models in the MRMDF.

D. On-Board Training. Payloads or experiments with a currency requirement that occurs on-orbit need to consider OBT. OBT has at least three uses: Refresher Training, Proficiency Training, and Just-In-Time (JIT) Training. OBT requirements will be defined by the TST, and the PD will be responsible for developing the OBT product. OBT will be discussed in more detail in Section 4.3.4.3.

4.1.2 Trainer Fidelity Requirements

This section provides top-level fidelity and interface requirements for the various types of training equipment defined by the Payload Classification for Training process. These requirements are intended to provide the PD with an overview of the training equipment for initial planning of development resources. Documentation containing more extensive information regarding the training fidelity, interface, and logistical requirements for each type of training equipment is also identified.

4.1.2.1 Integrated Rack (or Facility) Simulator for the SSTF/PTC

The integrated rack (or facility) simulator will consist of an integrated payload rack (Facility Rack, EXPRESS Rack, LSE Rack) to meet specified training requirements in the ISS environment. This simulator will provide physical interfaces and functional operations from the on-board crew's perspective; will support interfaces to the ISS (as simulated/emulated by the SSTF/PTC) to provide interaction with GSP at the SSCC, POIC, TSCs, or remote sites; and will support simulation-peculiar interfaces of the SSTF/PTC.

The integrated simulator will provide the functional and physical fidelity required to support all crew procedural training on nominal, routine maintenance and safety-related operations, as well as support training on malfunctions involving crew or equipment safety, or involving failures deemed likely to occur. Crew and GSP control and monitoring of the payload or experiment will be supported, including support for the Portable Computer System (PCS) or any laptops and support for health and status data to the POIC, TSCs, and remote sites. Interactions between the payload/experiment and other payloads/experiments or LSE/SSE will also be supported.

The SSTF/PTC will provide rack-level interfaces to the simulator for power (120/208 Vac), forced-air cooling, flight-like Command and Data Handling (C&DH) (via the 1553B and Payload Ethernet Hub Gateway (PEHG) interfaces), and simulation-unique control and monitoring (via the Payload Simulator Network (PSimNet) interface). The integrated simulator will support the flight-like interfaces for commanding and for providing monitoring data to the crew and the ground. The simulator will support the PSimNet for moding and malfunction control from the IOS in the SSTF/PTC, and will also provide resource usage data to the SSTF/PTC ISS core systems models via the PSimNet.

Detailed requirements for integrated rack (or facility) simulators can be found in the following documents:

A. Generic Payload Simulator Requirements, Volume 1, SSP 58026-01 (provides the requirements for a PTU). (Especially note Sections 3-6 and Appendix C.)

B. Payload Simulator Requirements Document, Volume 2 (payload-specific document defining support requirements, inventory, and trainer configuration).

C. Payload User Development Guide for the SSTF/PTC, SSP 50323, DRLI-92 (defines interfaces to the SSTF/PTC and SSTF/PTC facility requirements).

4.1.2.2 Integrated Sub-Rack Payload Simulator for the SSTF/PTC

An integrated sub-rack payload or experiment simulator will consist of the payload/experiment integrated into the EXPRESS or other facility rack. This simulator will provide physical interfaces and functional operations from the on-board crew's perspective, and will support interfaces to the host rack to provide interaction with GSP at the SSCC, POIC, and TSCs or remote sites.

The simulator will provide the functional and physical fidelity required to support all crew nominal, routine maintenance and safety-related operations, as well as support malfunctions involving crew or equipment safety, or involving failures deemed likely to occur. Crew and GSP control and monitoring of the payload or experiment shall be supported, including support for the PCS or any laptop, and support for health and status data to the POIC, TSCs, and remote sites.

The host EXPRESS or other facility rack will provide sub-rack interfaces to the simulator for power (28 Vdc), forced-air cooling, simulated C&DH (via an Ethernet interface), and simulation-unique control and monitoring (via an Ethernet interface). The simulator will support the flight-like interfaces for commanding and for providing monitoring data to the crew and the ground. The simulator will also support the simulation-unique interface for moding and malfunction control from the host rack. The host rack simulator will provide the rack's integrated resource usage data to the SSTF/PTC ISS core systems models.

Detailed requirements for sub-rack payload or experiment simulators can be found in the following documents:

A. Generic Payload Simulator Requirements Document, Volume 1, SSP 58026-01 (provides the requirements for a PTU). (Especially note Sections 3-6 and Appendix D.)

B. Payload Simulator Requirements Document, Volume 2 (payload-specific document defining support requirements, inventory, and trainer configuration).

C. Payload User Development Guide for the SSTF/PTC, SSP 50323, DRLI-92 (defines SSTF/PTC facility (logistical) requirements).

4.1.2.3 Stand-Alone Trainer

A stand-alone trainer will consist of a complete mockup of the layout, appearance, and interconnections of all payload or experiment hardware, and shall provide physical interfaces and functional operations from the on-board crew's perspective. The trainer will provide the functional and physical fidelity required to support crew nominal and routine maintenance operations, as well as support malfunctions involving crew or equipment safety, or involving failures deemed likely to occur.

Stand-alone trainers will be a table-top or a self-contained unit, requiring only power (120 Vac) or other standard service (e.g., air cooling, video monitors) from the host training facility. Note that stand-alone trainers shall physically attach into ISPRs or EXPRESS Racks to provide for a more realistic training environment if the appropriate capabilities exist.

Detailed requirements for stand-alone trainers can be found in the following documents:

A. Generic Payload Simulator Requirements Document, Volume 1, SSP 58026-01 (provides the requirements for a PTU). (Especially note Sections 3-6 and Appendix E.)

B. Payload User Development Guide for the SSTF/PTC, SSP 50323, DRLI-92 (defines SSTF/PTC facility (logistical) requirements).

4.1.2.4 Portable Trainers

Portable trainers include any kind of training media for which multiple copies can be provided in a format that can be used with commercial off-the-shelf hardware or software. These trainers allow many trainees in many locations to receive training, making them a convenient, cost-effective method for providing training. Portable training includes both traditional media such as video tapes, manuals, workbooks, and photographs, as well as electronic media such as CBTs and Internet-based remote learning.

It is required that CBT lessons be delivered on a CD-ROM due to their capability to provide diverse training information in a physically compact package. CBTs shall be built following the ISS On-Board Training Media Requirements to ensure compatibility with equipment on board the ISS.

Portable trainers will be developed to provide the trainee with information on payload or experiment overview, science, hardware layout, and software definition. The training can include information on nominal, maintenance, and malfunction operations required by the payload; and this should be provided in an interactive mode if a CBT is used. Portable

trainers can be used for crew training, as well as training for GSP. Portable trainers will be developed by the PD and provided to the SE. The portable trainers will go through the normal PTDR process.

4.1.2.5 Transfer Trainers

Transfer trainers will provide training for payload-/experiment-specific interfaces and operations required to transfer the payload or experiment between the transport vehicle and the ISS. Note that generic mockups will be provided by the program to support transfer training on all but unique payloads or experiments. If payload-/experiment-specific transfer training objectives are defined, the PD shall provide a lightweight envelope mockup of the payload or experiment hardware and a complete mockup of the physical interconnections between the payload or experiment and the ISS racks.

4.1.2.6 Transport Trainers

Transport trainers will provide training for special monitoring or maintenance operations required during transport to and from the ISS. This training will be provided to the ISS crew or the flight crew, depending on the mission-specific assignments for conducting these operations. Note that the transport trainer in most cases will not be a separate trainer; instead, previously defined PTUs or trainers will be used to support transport training.

4.2 CREW PAYLOAD TRAINING CURRICULUM

It is required that PDs define specific payload or experiment training curriculums for crew training. The PTI will define a specific payload complement training curriculum for the crew. The generic payload training curriculum and generic payload complement training curriculum, defined in this section, provide standard templates to assist the PDs and PTI in performing these tasks.

4.2.1 Generic Payload Training Curriculum

The generic curriculum for an individual payload or experiment consists of six major subject matter areas to consider when defining crew payload training content/courses.

A. Payload/Facility Overview. Top-level training on the purpose of the payload or experiment, scientific discipline supported, and payload/experiment description.

(1) Payload Science Background. Training on payload/experiment objectives, investigative parameters, and anticipated scientific results for a specific payload/experiment subelement.

(2) Payload Systems Overview. Top-level training on the components of the payload or experiment, how these components interface to each other and to ISS systems, and safety considerations in payload/experiment design through operational hazard controls.

(3) Payload Operations Overview. Top-level training on the operations that must be performed and constraints that must be adhered to in order to fulfill experiment objectives and safety considerations through operational hazard controls.

B. Payload Science Applications. Science skills building and laboratory work.

C. Payload Nominal Operations. Training on those activities and/or procedures that will be performed on board the ISS to support nominal payload/experiment execution and safety constraints.

D. Payload Malfunction Operations. Training on those activities that may be performed on board the ISS to correct payload or experiment problems and react to scientific results. This training is generally limited to recognition of malfunctions and action needed to safe the payload or experiment, malfunctions likely to happen, those with safety issues, or those causing a devastating loss of science.

E. Payload Transfer. Training on the transfer of payload or experiment equipment from/to the transport vehicle to/from the ISS, installation, and connection of the equipment.

F. Payload Transport. Training on those activities that will be performed on board the transport vehicle to support nominal transport of payload or experiment equipment or to correct problems which may occur while payload or experiment equipment is on board the transport vehicle.

Each of these six subject matter areas in the generic curriculum is divided into more detailed objectives. Figure 4-2 illustrates the generic payload training curriculum for an individual payload or experiment. This entire curriculum, or just portions of the curriculum, may be applicable to a specific payload or experiment. PDs, with assistance from the SE, can customize this generic curriculum to correctly identify the required content of training for their payload or experiment. Once a PD defines the specific training curriculum for their

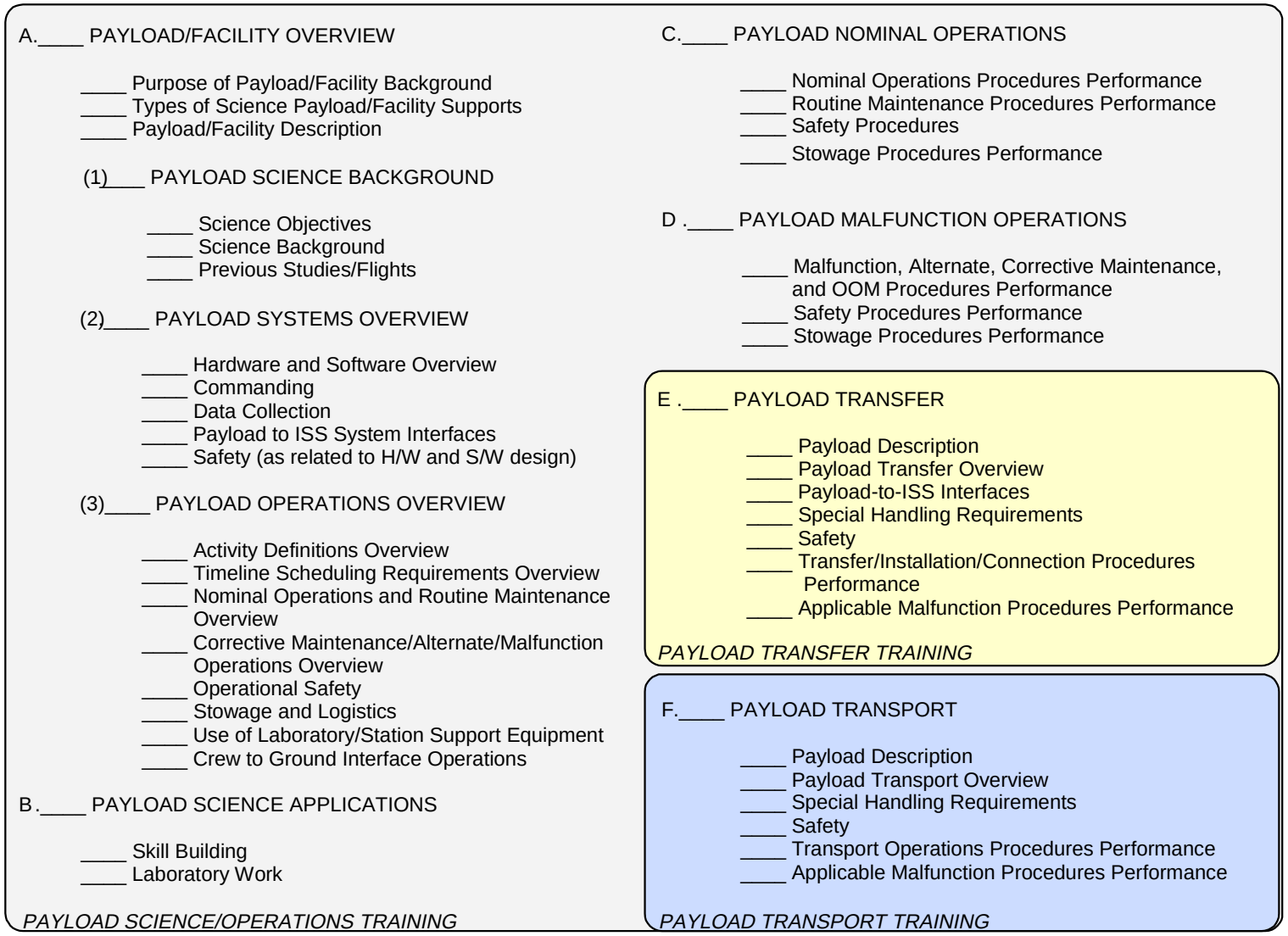


FIGURE 4-2 GENERIC PAYLOAD TRAINING CURRICULUM

payload or experiment, that curriculum should serve as a guideline for the development of training lesson plans, courseware, and training tools. The curriculum for each payload or experiment is considered part of the Payload Training Data Set.

4.2.2 Generic Payload Complement Training Curriculum

The generic payload complement training curriculum consists of four major subject matter areas to consider when defining crew payload complement training content/courses.

A. Payload Complement Orientation (not applicable to individual PD elements).

(1) Introduction at I-18 to the ISS payload complement science, components, configuration, and training schedules.

(2) Orientation at I-7 of payload complement operations concepts, resources, constraints, and personnel. A short summary (1-2 pages) for each payload or experiment will be included in these briefings.

B. Payload On-Board Products Overview. Summaries and descriptions of all on-board procedures, reference material, and training material. Detailed training on integrated procedures. Training on the access, modification, and use of payload procedures and timelines.

C. Payload Complement Support Equipment. Training on all LSE/SSE and stowage on board to support the payload complement.

D. Integrated Operations Execution. Training on the operations of suites of payloads and experiments and their support equipment by executing on-board procedures and timelines.

Each of these four subject matter areas in the generic curriculum is divided into more detailed objectives. Figure 4-3 illustrates the generic payload complement training curriculum. This entire curriculum, or just portions of the curriculum, may be applicable to a specific payload complement. The PTI can customize this generic curriculum to correctly identify the required content of training for the payload complement. Once the PTI defines the specific training curriculum for the payload complement, that curriculum should serve as a guideline for the development of training lesson plans, courseware, and training tools. The following section will include a definition of the six types of crew payload training and illustrate how the generic payload and payload complement curriculums are implemented.

A.____ PAYLOAD COMPLEMENT ORIENTATION (Not applicable to individual PD elements) (I-18)

____ Science Overview
____ Payload Complement Components and Configuration
____ Payload Training Schedules
____ Resources and Constraints*
____ Operations Concepts and Personnel*
____ POIF Overview*

* = Happens at I-7

B.____ PAYLOAD ON-BOARD PRODUCTS OVERVIEW (I-7)

____ On-Board Products (Individual and Integrated)
____ On-Board Reference Materials
____ On-Board Training Materials
____ Access and Use of On-Board Products

C.____ PAYLOAD COMPLEMENT SUPPORT EQUIPMENT (I-7)

____ Tools
____ Photo/Video Equipment
____ Laboratory Support Equipment/Station Support Equipment
____ Stowage

D.____ INTEGRATED OPERATIONS EXECUTION (I-6)

____ Payload Complement Activation
____ Power Down Scenarios
____ Rapid Safing
____ Subsystem Operations & Anomalies affecting Payloads
____ Timelined Payload Operations
____ Payload Photo/TV Operations
____ Payload Stowage

PAYLOAD COMPLEMENT TRAINING

FIGURE 4-3 GENERIC PAYLOAD COMPLEMENT TRAINING CURRICULUM

4.3 PAYLOAD TRAINING TYPES AND PHASES

This section will define payload training types and the phases of payload training. This section should assist training personnel in determining the content and objectives of payload training and the methods for implementing the training. These definitions are intended to promote the use of common training terminology, ease the integration of training plans and schedules, and ensure comprehensive and efficient training for each payload or experiment.

The payload training phases defined in this section are Advanced, Increment-Specific, and On-Board. The payload training types are spread across these three phases which start with Advanced at I-30, Increment-Specific at I-18, and On-Board after launch. Although broad in nature, these phases create a distinct demarcation for training which starts out with general, overall payload knowledge leading to specific payload or experiment training leading to eventual on-board training.

4.3.1 Crew Payload Training Types

The six types of crew training defined in this section are based upon the need to fulfill a defined curriculum for an individual payload or experiment, as well as to meet training objectives defined for a specific payload complement. The section will identify the six types of crew payload training and illustrate how the generic payload and payload complement curriculums are implemented. Note that Payload Instructors for each of the types of crew payload or experiment training could be SEs, JSC Payload Instructors, and/or PD-provided Instructors depending upon the location of the training and the complexity of the operations.

4.3.1.1 Payload Science/Operations Training

Payload Science/Operations training will be conducted on a single payload or experiment to provide the crew with an overview of the payload/experiment, introduce the crew to the payload's or experiment's operations, and build the crew's knowledge in specific payload or experiment skills and tasks. This training will provide the crew with payload or experiment orientation material; payload/experiment science, technology, or commercial research background and applications; an overview of payload or experiment components and system interfaces; an operations overview; and an introduction to nominal, maintenance, and malfunction operations. Refer to Figure 4-2 for an illustration of the portions of the generic payload training curriculum that can be fulfilled by this type of training.

Typically, classroom presentations will be used to provide complete overviews of the payload/experiment science, components, system interfaces, operations, and logistics. Hands-on training will be conducted to allow the crew to observe and/or perform the

nominal, malfunction, and maintenance procedures which may be performed on board the Space Station. Training on LSE/SSE will be included, as required, to support specific payload or experiment operations tasks. The provision of overview and reference materials combined with performance of detailed procedures will allow the crew to start building proficiency on all of the skills and tasks associated with nominal, maintenance, and malfunction operations.

Payload Science/Operations training for a new payload or experiment will typically occur in the I-18 to I-6 timeframe, depending upon when the payload or experiment is identified and/or manifested. This type of training for payloads or experiments with extremely simple crew operations, no safety considerations, and/or which are identified late could be conducted on board if the PD approves of this method. For later increments when a payload or experiment has obtained steady-state operations on board, portions of this training may be moved into the Advanced training phase (I-30 to I-18).

All of this training will occur at JSC unless a waiver has been obtained to travel to a PDC for some specialty skills training. If travel to a PDC is required, a brief payload or experiment orientation will be conducted at the SSTF/PTC prior to traveling to the PDC for more in-depth training. This type of orientation training may include a classroom presentation, CBT modules, training videos, and/or use of an SSTF/PTC PTU. The availability of training resources from previous increments will determine the appropriate medium(s) for this type of orientation. Training locations and Payload Instructors will be coordinated with the SE during the TST process.

4.3.1.2 Payload Transport Training

Payload Transport training will instruct the crew on all nominal and malfunction operations which may be performed while the payload or experiment is on board the transport vehicle (i.e., Space Shuttle, Soyuz). While Payload Science/Operations training is directed at the Station crew, Payload Transport training will be performed for the crew of the transport vehicle (which may or may not be the same as the Station crew). This training may include a brief classroom introduction to the major payload/experiment components and transport operations. Hands-on training will be performed to build the crew's proficiency on all nominal, maintenance, and malfunction procedures that would be associated with transport operations. Transport training may include anything from routine maintenance operations on payload/experiment hardware components to detailed, subject-oriented data runs of experiment protocols. Note that this crew training type directly correlates to the Payload Transport curriculum item defined in Figure 4-2.

Payload Transport training will typically occur at the SSTF/PTC in the I-12 to I-6 timeframe. Payload Instructors for this training will be coordinated with the SE during the TST process.

4.3.1.3 Payload Transfer Training

Payload Transfer training will instruct the crew on the activities that must be performed to transfer unique payload or experiment equipment from the transport vehicle to the Space Station, and install and connect this equipment in the appropriate location. Payload Transfer training must also be performed for removal of payload or experiment equipment from the ISS with installation and connection in the transport vehicle for return. This training may be directed at either the Station or transport vehicle crew, dependent on the defined operator for the transfer activities. The Payload Transfer training may include a classroom overview as well as hands-on training to introduce the crew to detailed procedures and build the crew's proficiency on payload-/experiment-specific tasks.

Transfer of payload equipment may include rack transfers, payload sub-element transfers, or transfer of individual samples/stowage items. The crew will require training on unique installation tasks for rack-to-Station interfaces, payload/experiment-to-rack connectivity, payload-to-payload interfaces, experiment-to-experiment interfaces, and/or rack-to-transport vehicle interfaces. Note that generic tasks associated with the transfer and connection of ISPRs, lockers, and other standard equipment are not payload-specific and will be accomplished during the Advanced training phase in the SSMTF at JSC. Note that this crew training type directly correlates to the Payload Transfer curriculum item identified in Figure 4-2.

Payload Transfer training will occur in the I-12 to I-6 timeframe. Physical transfer and connectivity training will be performed at the SSMTF using transfer trainers or stand-alone trainers borrowed from the SSTF/PTC. Training on any type of checkout activities will typically be performed at the SSTF/PTC, depending upon the SSTF/PTC simulator's ability to support these operations. Locations and Payload Instructors for this training will be coordinated with the SE during the TST process.

4.3.1.4 Payload Proficiency Training

Payload Proficiency training could consist of nominal, maintenance, and malfunction procedure execution; transport activities; and payload-/experiment-specific transfer operations for a single payload or experiment. Currency requirements are associated with proficiency training to identify the maximum time allowed between training sessions or between training and operations to maintain the agreed to level of proficiency. Table 4-I lists

guidelines to aid the TST in determining payload-/experiment-specific currency requirements.

Proficiency training will not be used to introduce new knowledge or skills. The objective of Payload Proficiency training will be to maintain the crewmember's proficiency in detailed payload or experiment skills and operations. Science activation/deactivation, preventive maintenance, logistics, processing, support equipment, transport, and payload-/experiment-specific transfer activities could be performed to maintain proficiency in nominal payload and experiment operations. Currency is not required on nominal operations (i.e., powerup/powerdown, activation/deactivation, maintenance procedures, status checks, etc.) as long as clearly defined procedures exist that require no decision-making by the crewmembers. Off-nominal scenarios could be included in this training to maintain the crewmember's skills in the definition and recognition of possible failures, the implications for continued operations, and the performance of malfunction and corrective maintenance procedures. Training that serves as a hazard control may also be included.

TABLE 4-I CURRENCY REQUIREMENTS GUIDELINES

LIST OF PAYLOAD TASKS	FREQUENCY
Safety or Hazardous Operations Tasks (Samples/materials, fire detection, CO2 pressure vessel/cylinder exchange, operating conditions (temperature, etc.))	3 to 6 months
Malfunction Procedures Tasks (Loss of uplink commanding capability, problems with power, temperature excursions, communications problems, emergency shutdown, plant growth environment problems, out-of-limit readings) - Responding to malfunctions to maintain science integrity - Responding to malfunctions to protect the experiment or LSE hardware	 3 to 6 months 6 to 9 months
Specialty Skills (Decision-making, plant sample harvesting and fixing, gas/liquid sample extraction, cell inoculation, cell sample processing and storage, plant pollination, video or microscope adjustments, blood draws, special sample handling, etc.)	3 to 6 months

Payload Proficiency training may include both Station and transport vehicle crew, dependent upon the defined operator for specific transfer and transport tasks. The primary medium for Payload Proficiency training will be hands-on, although classroom sessions or portable training could be utilized to review procedures, review and status configuration changes, and debrief training sessions. Payload Proficiency training could start at approximately I-12, will continue through crew launch, and may also occur on board.

Sessions will be repeated at predefined intervals to meet currency requirements. Increment-specific payload hands-on training occurring 15 months prior to flight will be reviewed on a payload/experiment basis to determine if additional training is needed. The PD, SE, and PTI shall be responsible for determining the need for additional training. The PD should identify any currency requirements in their Payload Training Data Set for each of the six major curriculum items shown in Figure 4-2. Payload Proficiency training will typically be conducted at the SSTF/PTC; however, if proficiency in specialty skills is required and has been waivered, return travel to a PDC may be required up through I-6. Locations and Payload Instructors for this training will be coordinated with the SE during the TST process. With the PD's prior consent, Payload Proficiency training can also be reinforced through simulations and Payload Complement training.

4.3.1.5 Payload Refresher Crew Training

Payload Refresher training for the crew will be training conducted on an individual payload or experiment at the request of the crew. These sessions are not part of the planned curriculum for a given payload or experiment. Payload Refresher training will be added to the planned curriculum to give the crew additional training on a given payload/experiment or particular aspects of a payload or experiment. The training could be a handout, a subset of a previous course or courses, a CBT lesson, or an abbreviated hands-on session conducted with an instructor. Payload Refresher training will most likely occur in the I-6 through crew launch timeframe or on board. As with Proficiency training, Refresher will not include new knowledge or skills. This training will typically be conducted at the SSTF/PTC, SSMTF, or in Russia. Locations and Payload Instructors for this training will be discussed with the PTI and coordinated with the PAYCOM during training implementation.

4.3.1.6 Payload Complement Training

Payload Complement training for the Station crew will be conducted to provide instruction on all equipment, products, and procedures that will be required to operate a defined payload complement. This crew training type will serve to fulfill the payload complement curriculum objectives identified in Figure 4-3.

Prior to the execution of Payload Complement training, there will be an Increment Training Readiness Review (ITRR) held by the PTI at approximately I-19. This review will demonstrate the readiness of the payload training team to execute payload and experiment crew training for a given increment. A status/schedule for the payload's facilities, equipment, courseware, hardware/software, procedures, OBT lessons, and instructors supporting the given increment will be given. In addition, training schedules will be presented as well as preliminary information on the increment's simulations and Payload Complement training.

A Payload Complement orientation will be conducted early in the training flow at approximately I-18 to introduce the assigned crew to the identified payload complement for a specific increment. The orientation should occur at the SSTF/PTC and serve as a "kick-off" to Increment-Specific training. Payloads or experiments not identified at I-18, such as standard EXPRESS, will not be included in this orientation but will be included in the I-7 payload complement briefing. The objective of this training will be to provide the crew with a summary of payload/experiment elements. This orientation will consist of classroom presentations and, if available, a walk-through of the lab environment. The PTI will conduct this orientation with assistance from POIF personnel and Payload Instructors.

Later in the training flow, Payload Complement training will also include a detailed briefing about the on-board products and support equipment the Station crew will be utilizing. The briefing would cover, as a minimum: a description of increment payload/experiment resources and configuration, an introduction to key payload operations and training personnel, an overview of the payload training schedule, individual and integrated procedures the crew will use on the Station Support Computer (SSC) for the increment, reference materials available, a representative example of an On-board Short Term Plan (OSTP) and On-Orbit Summary (OOS), expected OBT to be conducted (how/when), tools expected to be used, expected use of LSE/SSE, and the stowage plan. The PTI would conduct this with the assistance of subject matter experts in the I-7 timeframe.

Payload Complement training will also include hands-on training in the operation of combinations of payloads and experiments and support equipment/activities relative to a representative increment timeline. These sessions held at the I-6 timeframe will include the execution of both individual and integrated payload procedures, focusing on crew-intensive operations. Examples of these activities include rapid safing of the payload complement, payload complement response to system failures, usage of Station systems and support equipment by the payload complement, and an awareness of the potential impacts that operating one payload may have on another. These sessions will build and maintain the crew's proficiency at operating suites of payloads and experiments in their flight environment.

4.3.2 GSP Training Types

This section will discuss the three types of payload training that will be performed for GSP. It should be understood that GSP refers to all ground personnel (i.e., cadre, science teams, PDs, remote personnel, etc.).

4.3.2.1 Generic Operations Training

Generic Operations training for GSP will provide instruction on payload ground facilities; generic ground operations; ground team organizations, interactions, and functions; ISS systems, payload support systems, and operations; and LSE/SSE. The objective of this training will be to provide POIC cadre, TSC personnel, and science teams with an introduction to and familiarization with the facilities, systems, personnel, and processes which will be involved in the execution of ISS payload operations. This training should be completed before participation in simulations.

Science teams will be responsible for providing generic operations training on their internal systems and operations to their own GSP. The POIF will be responsible for providing training on how to utilize and interface with the POIC. The POIC training that a specific individual will receive is determined by the location that the individual will perform operations from as well as that individual's specific functions within his/her team. Workbooks, briefings, video tapes, WWW, CBTs, and hands-on training will all be utilized to conduct this training for GSP. The Payload GSP Training and Certification Plan will provide detailed information on the responsible organizations, locations, and curriculum for GSP training.

4.3.2.2 Position-Specific Training

This training will include the specific details of how to perform each function of every position staffed. The development, maintenance, and implementation of the training is the responsibility of the organization tasked with staffing that position. This training should be completed prior to participation in simulations.

4.3.2.3 Payload-Specific Training

Payload-Specific training for POIC cadre will provide instruction on all operations, activities, and products associated with individual payloads or experiments and the integrated payload complement. This training should occur no later than I-6. Science teams will be responsible for providing payload-specific training to their own GSP.

4.3.3 Simulation Types

This section will discuss the three payload training types of simulations. It should be noted that the end result of GSP training and sims is the appropriate GSP being certified at Certification of Flight Readiness (CoFR).

4.3.3.1 Payload-Only Simulations

GSP Payload-Only Simulations will be conducted to exercise ground personnel on the processes and procedures supporting operation of a payload complement and support equipment/activities in a simulated mission environment. The objectives of this training will be to exercise ground procedures, react to on-board activities, and practice the execution and maintenance of integrated payload products which are critical to the success of ISS payload operations. Note that there will be no crewmembers participating in these simulations.

Simple simulations will be performed for POIC cadre and science teams to allow proficiency building in console operations, interfaces, and products. These simulations will involve low-level support from training and operations facilities and execution of generic scripts and tasks.

GSP Payload-Only Simulations will be conducted for the U.S. element and the entire ISS payload complement in the I-12 through launch timeframe. Depending upon the makeup of the payload complement, this training may be limited to a single new science team working with the POIC cadre or may involve numerous personnel at TSCs or remote sites interacting with the POIC. Some specific objectives of this training environment will be:

A. Exercise the GSP members in console workstation usage.

B. Exercise the GSP members in voice protocol.

C. Exercise the GSP members in working voice and data interfaces.

D. Exercise the GSP team members in console procedures such as trouble reporting, A/G procedures, payload regulations, flight rules, console handbooks, and handovers.

This training will be supported by the appropriate training facilities such as the Remote Area for Payload Support (RAPS) and SSTF/PTC and possibly other TSC or remote facilities. The Payload Simulation Director and Increment Simulation Supervisor plan and conduct these simulations with the assistance of the Payload Simulation Coordinator, SEs, and TSC training representatives. The Payload Simulations Guidelines Document will provide more detail on these types of simulations.

4.3.3.2 Integrated Payload-Only Simulations

Integrated Payload-Only Simulations will be conducted to exercise crew and GSP on the processes and procedures supporting operations of a payload complement and support equipment/activities. This training will occur in the I-6 to I-3 timeframe. The objective of this team training will be to provide a simulation environment in which the crew and GSP teams dedicated to payload/experiment operations can exercise payload- or experiment-

specific interfaces and procedures in a flight-like environment. Some specific objectives of this training environment will be:

A. Work POIC/science teams/crew coordination for each shift.

B. Increase proficiency in nominal and contingency operations for ISS crew and GSP dedicated to payload/experiment operations.

C. Develop proficiency in crew and GSP payload-/experiment-specific interfaces in a flight-like environment.

D. Exercise GSP cadre/science teams/crew in procedures and output products.

E. Exercise handovers.

Integrated Payload-Only Simulations should include the Station crew, POIC cadre, and other GSP teams dedicated to payload operations. The Station crew will participate from the SSTF/PTC and will interact with the payload/experiment and system simulators resident there. Data, commanding, video, and voice interfaces will be extended from the SSTF/PTC to the POIC, and then to the respective TSCs or remote sites. The Payload Simulation Director and Increment Simulation Supervisor will plan and conduct these simulations with the assistance of the Simulation Coordinator, SEs, STL, and TSC training representatives. The Payload Simulations Guidelines Document will provide more detail on these types of simulations.

4.3.3.3 Joint Multi-Segment Training

JMST will be conducted to exercise the crew and GSP on the processes and procedures supporting the Space Station systems. In some cases, Space Shuttle simulators and personnel will be included to exercise activities involving interfaces and coordination between the Shuttle and Station. In some instances, the payload complement and its support systems/activities will be exercised. From a payload perspective, the objective of this training will be to provide a simulation environment in which the payload community can incorporate interfaces with the SSCC or MCC-H into the environment already mastered during Integrated Payload-Only Simulation training. The addition of these new interfaces will increase the fidelity of the exercises and provide more realistic feedback and operational scenarios for the payload community. JMST payload participation in this training will occur in the I-3 to launch timeframe.

JMST for the payload community will involve the Station crew and the GSP/facilities at the SSCC, TSCs or remote sites, and POIC. The Shuttle crew and MCC-H can also be incorporated into these simulations. Data, commanding, video, and voice interfaces will be

extended to the payload community in a manner similar to the “real world” environment. The Payload Simulation Director and Increment Simulation Supervisor will coordinate the payload/experiment training objectives, scenarios, and activities for these simulations with the various training organizations and the STL. The STL will be responsible for the overall planning and execution of this training. Some specific objectives of this training environment will be:

A. Increase proficiency in which the payload community can exercise interfaces with the ISS crew.

B. Exercise and validate JSC/MSFC interfaces during transport, transfer, and activation of experiments and payloads.

C. Work crew/POIC/ MCC-H coordination for each POIC shift.

D. Complete checkout of all payloads/experiments.

E. Exercise payload regulations and flight rules.

F. Exercise handovers.

4.3.4 Payload Training Phases

The following sections will discuss guidelines for implementing payload or experiment training during the Advanced, Increment-Specific, and OBT phases.

Payload training for the crew will occur during the Advanced, Increment-Specific, and On-Board phases of ISS training. Basic training for the crew, providing instruction on basic skills and knowledge, will be completed prior to the beginning of any payload or experiment training. Note that ISS crewmembers will receive rudimentary science discipline training as part of Basic training. This training will serve as a cornerstone for the more specific payload or experiment science training which the crew will receive as part of the curriculum for a specific payload or experiment. Figure 4-4 is provided to illustrate how the 12 types of payload training, which involve the crew and GSP, correlate to these training phases.

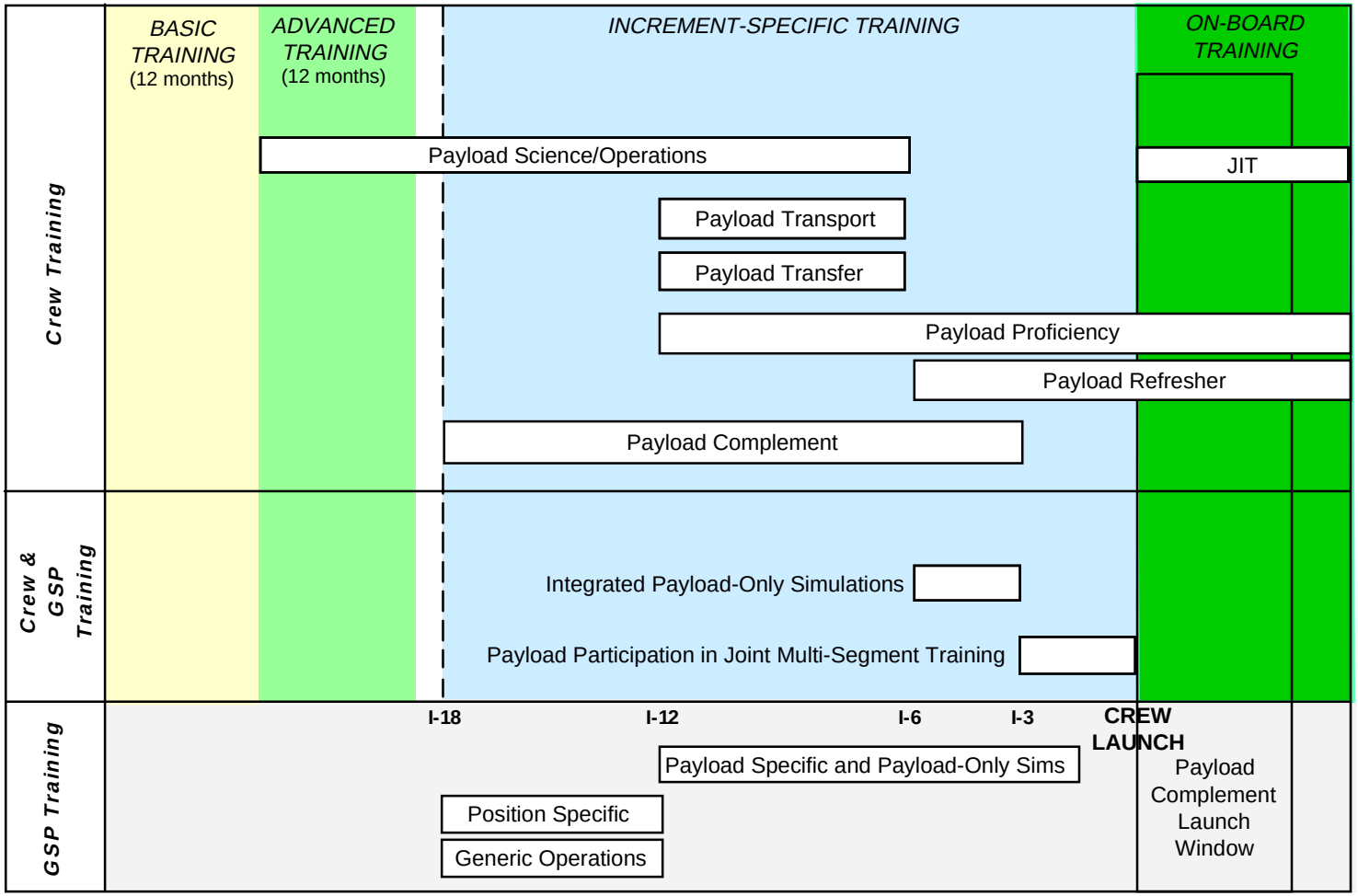


FIGURE 4-4 PAYLOAD TRAINING TYPES AND PHASES

4.3.4.1 Advanced Training

During the Advanced training phase, crewmembers will receive training on facilities/payloads/experiments and support equipment which are permanently resident on board the ISS. Payload training at this time will be focused on generic payload/experiment tasks and standard payload or experiment operations, rather than tasks and operations specific to a particular increment. Payload Science/Operations training could begin in the Advanced training phase for long-term payloads/experiments, including facility class payloads, currently on board the Space Station. This training will be conducted at the JSC unless a waiver has been granted to allow travel to a PDC. CBT modules, training videos, and training manuals should be an important source of crew payload training material during the Advanced training phase. A major factor in attempting to provide this training in the Advanced phase is to off-load payload training hours from the Increment-Specific phase, where heavy training loads and travel constraints limit the crew's availability.

The payload portion of Advanced training will continuously change as new facilities/ payloads/experiments and/or support equipment are integrated on board the ISS and other payload/experiment equipment returns. PDs, SEs, and crewmembers will work with the PTI to make recommendations on which payload or experiment training courses should be added to, deleted from, or modified for the Advanced training for future increments.

4.3.4.2 Increment-Specific Training

Subject areas covered during the Increment-Specific phase will include payload and experiment science/operations and proficiency training on all payload tasks associated with the defined payload complement. Training during this phase will emphasize payload and experiment operations which are unique to the upcoming increment. Crewmembers will complete their individual payload/experiment training curriculums, and the focus of their training program will turn to team training.

At the beginning of the Increment-Specific phase, crewmembers for the increment will be announced along with their specific job assignments. During this training phase, PDs and SEs will work with the PTI to ensure that the individual payload/experiment curriculum created for each crewmember meets the training objectives determined necessary for their specific job assignments. PD, SE, and PTI coordination during this phase will be critical in fulfilling all the defined payload and experiment training requirements while adhering to crew travel constraints imposed by the ISS Program.

During the Increment-Specific phase, the crew will complete Payload Science/ Operations training for individual payloads and experiments. The crew will also receive, based upon their job assignments, Payload Transport and Payload Transfer-type training.

Payload Proficiency training will be performed to fulfill currency requirements, and Payload Refresher training will be conducted as needed at the request of crew. Payload team training, involving two or more crewmembers, will begin with Payload Complement training. Refer to previous sections for specific details of all of the crew payload training types discussed here.

The Increment-Specific phase will culminate in payload and experiment team training combining both the crew and GSP. Integrated Payload-Only Simulations will serve to meet a majority of the payload training objectives requiring a high-fidelity simulation environment and crew-to-GSP interfaces. Payload objectives may also be fulfilled in some of the JMST which occurs during the Increment-Specific phase.

4.3.4.3 On-Board Training

Payloads and experiments with currency requirements may need to consider developing OBT materials. OBT is an opportunity with at least three uses: Refresher training which is performed at the crew's initiative on an as-needed basis, Proficiency training which is required to maintain certain Skill, Knowledge, Attitudes (SKA) and is scheduled in the timeline, and JIT training which introduces new information or training before specific task execution and is scheduled in the timeline. OBT products should also be considered for use prior to launch to support crew travel, GSP training, and Advanced training. OBT includes, but is not limited to, CBT modules, training videos/photos, training manuals, video conference/uplink capabilities, crew handovers, spare samples, or hands-on operations.

The TST will determine the training possibilities for OBT. If OBT is a requirement, the PD will submit the requirements into the PDL Training Data Set. The PD will be responsible for developing the OBT lesson plans, instructional material, and final product. The PD will be responsible for delivering the OBT product per the negotiated Level V Schedule developed by the SE. A PTDR will be conducted on the final product when applicable.

It is important to note that all on-board resources (including crew time) that OBT requires come out of that payload's operations allotment. Therefore, it is imperative that PDs put their OBT requirement into the interim User Requirements Collection (iURC) so Planning personnel can plan the payload resources needed accurately. OBT hours will not be carried as payload training hours.

4.3.4.3.1 On-Board CBT Development and Certification

A commonly used medium for OBT is the CBT. This sub-section will discuss the development, coordination, and certification for CBTs used to implement OBT. The flow reflects an iterative review and development cycle and could serve as a model for

development of other OBT media. For all final OBT products, a verification and acceptance review will be conducted regardless of the medium used for OBT.

The broad objective of the Payload On-board Computer-Based Trainer (OCBT) Development Flow (shown in Figure 4-5) is to ensure the proper coordination and integration of OCBT products into the overall training plan for a payload/experiment or facility. The OCBT Development Flow is based on the principle of continuous evaluation throughout development, and its success depends on consistent communication and coordination with the SE and the On-Board Training Working Group (OBTWG) U.S. Payload Representative beginning during conceptual design.

Development of every OCBT must comply with the ISS OBT Media Requirements (SSP 50503). If the CBT lesson does not comply with the MRD, the PD must request a waiver to use the CBT as is. At any point in development, the PD may request informal criterion referenced evaluations of the OCBT. However, the PD is encouraged to request these evaluations during the early design stages to identify potential technical problems and to avoid possible negative impacts to schedules and budgets as the timeline nears the critical integration dates. The final verification and acceptance review for the OCBT will occur via the PTDR, which is essentially a system test and evaluation review of this payload training tool. At the PTDR, the payload OCBT product will be assessed in terms of its overall performance and instructional effectiveness. Continuous evaluation and coordination will ensure the final OCBT product will meet the training objectives and the ISS integration requirements defined by the payload-specific TST and the OBTWG. Following is a delineation of the proposed timeline, steps in the flow, prerequisites to each step, individual responsibilities, and outcomes and deliverables resulting from each step.

The flow shown in Figure 4-5 should begin between L-24 and L-12. During this timeframe, the payload-specific TST will define the overall training objectives and requirements. If the TST decides to use an OCBT to meet specific training requirements, the PD will be required to provide preliminary OBT objectives to the team. The PD also will provide a preliminary synopsis, software requirements, and other OBT-specific information to the SE on a preliminary ISS OBT Description Form (see SSP 50503) which the OBTWG will use for planning purposes. Other deliverables at this point will include the OCBT milestones which are input to the Level V Schedule.

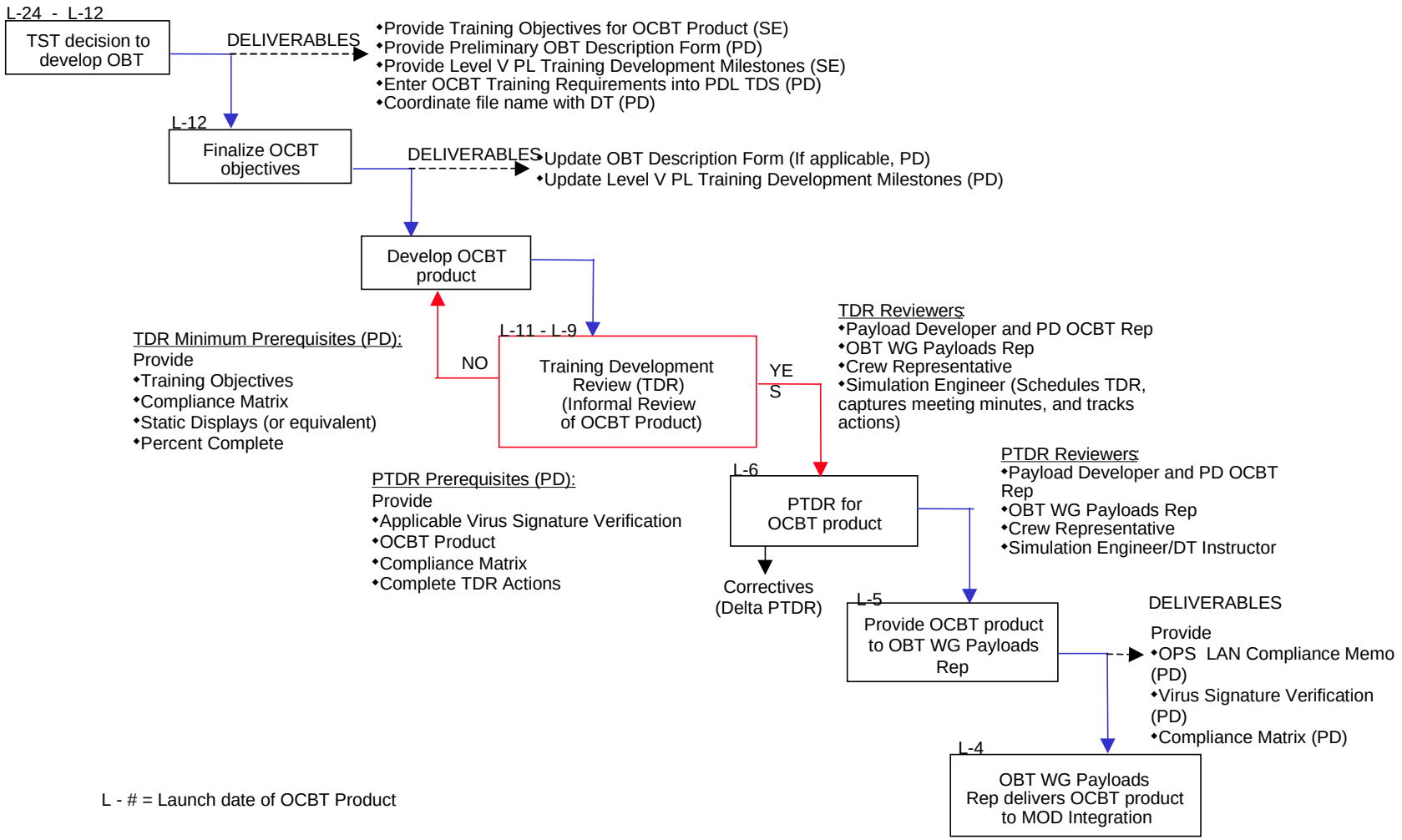


FIGURE 4-5 PAYLOAD OCBT DEVELOPMENT PLAN

At L-12, OCBT objectives should be finalized by the PD, who will be responsible for updating and resubmitting the ISS OBT Description Form as necessary and updating the OCBT Level V milestones with the SE. The ISS OBT Description Form will serve as the operations concept for the OCBT product. The U.S. Payload OBT Representative will review the preliminary synopsis for completeness and present it to the OBTWG for increment-specific OBT planning purposes.

During the L-11 through L-9 period, an informal and iterative evaluation relationship exists among the SE, PD, and U.S. Payload OBT Representative. The PD will have the option to request preliminary reviews to assess training objectives and technical compliance; however, the PD must work with the SE to coordinate and schedule a Training Development Review (TDR) during this time period. At a minimum, the prerequisites to be provided by the PD at the TDR will include the training objectives, a compliance matrix, static displays (or equivalent), and information on percent complete. The compliance matrix shall indicate the level of compliance with requirements specified in the Media Requirements. (A sample compliance matrix is provided in the Media Requirements, Appendix C.) The TDR participants will include the PD and PD OCBT Representative (if applicable), the U.S. Payload OBT Representative, a crew representative, and the SE. The SE will capture meeting minutes and track any resulting actions.

All payload OCBT products used by the crew will be officially accepted via the PTDR process (see Appendix E). At L-6 the PTDR will be performed to certify the particular OCBT product. The PTLP for the OCBT product should be used during the PTDR. Prior to the PTDR, the PD will be responsible for internally verifying that the OCBT product meets the OBT media requirements. Prerequisites to be provided by the PD will include the applicable virus signature verification, the OCBT product, a compliance matrix, and completion of the TDR actions. If the PD has to make major corrections or improvements in order to certify the OCBT, a delta PTDR may be required. Successful completion of the PTDR and certification of the OCBT product will establish a baseline for the particular OCBT product. Any changes to the OCBT product baseline will require coordination with the responsible SE and U.S. Payload OBT Representative. The delta PTDR process used for changing other training products will be used for OCBT products.

Per the current MRD, the certified OCBT product, OPS LAN Compliance Memo, virus signature verification, and compliance matrix must be prepared and then delivered to the U.S. Payload OBT Representative at L-5. The U.S. Payload OBT Representative will deliver the OCBT product to the MOD Integration Representative at L-4. The MOD Integration Representative integrates the final product for delivery on the SSC and maintains configuration control of the software.

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SECTION 5, PAYLOAD TRAINING PROCESS FLOW

The NASA Payload Training Process Flow defines the processes, activities, milestones, personnel, and products involved in the planning and implementation of payload training for the ISS. Figure 5-1 illustrates this complicated process flow. Since this broad and varied information is talked about in different sections of this document, all the pertinent information is placed on one chart to assist one in seeing the logical progression from tactical planning to crew on-board working with payloads and experiments. Per Figure 5-1, the major processes involved in payload training and where they are explained in detail in this document are as follows:

A. Documentation and databases (Section 2).

B. Payload training analysis, planning, and implementation (Section 4).

C. Tactical planning, training strategy, development of the MITP, payload training schedule development, training administration (Section 5).

D. Training development/verification/certification, payload complement verification, RAPS training support (Section 6).

E. Payload Instructor training and certification (Section 7).

F. Simulation planning and verification (Section 8).

5.1 PAYLOAD TRAINING INTERFACE TO TACTICAL PLANNING

The tactical planning process will be the first activity in which crew training requirements for a given payload or experiment are defined. The planning of crew payload training is an important aspect of payload tactical planning. Using the Operations Summary as a guideline for resources and beginning with the start of the PIA or EIA development, planning personnel will coordinate with the PTI and the PDs to estimate crew training hours needed for each payload or experiment. The crew training hour estimates are then documented in the PIA/EIA for each payload/experiment.

Once the Increment Definition Requirements Document (IDRD) is baselined, the estimated crew training hours for each payload or experiment in the manifested complement will be fed back into the training strategy process for the individual payloads/experiments

PTI
Provides Inputs to Long Range Training Schedules

Long Range Crew Training Schedule

To Top-level Crew Training Schedules

Operations Summary

TACTICAL PLANNING PROCESS

Payload Planning & Resources Tactical Utilization Plan Development

IDRD Baseline I-18

Payload Complement Manifest

Crew Training Hours

PIA/EIA Development

International Training Control Board

Payload Training Panel

MITP input for payloads

From PDL

Crew Office Crew & Job Assignments (I-20)

Level II Schedule from program

Level III Schedule POIF POD

Assembly Sequence Schedule

From PDL

FROM TST PROCESS

Crew Training Requirements

TRAINING ADMINISTRATION

Crew Training Coordinator Coordinate day to day crew payload training with CAM

Crew Training Coordinator Input as-trained hours into TAMS

PTI Coordinate advanced payload training with ITI for the execution and planning of payload training during the advanced phase

Coordination of Facilities, Trainees, Instructors, and Schedules to Implement Training

Daily Schedules

Payload Input to Crew Certification Process

Payload Instructor Write Training Reports

POIC Cadre Assignments (I-12)

Payload GSP Trng & Certification Plan

PGSPT GSP Training Matrix Development

Training Matrix (I-9)

PGSPT Individual GSP Schedule Development

Schedules Per GSP

Daily Schedules

PGSPT PDL GSP As-Trained Database

Inputs after Training Complete

SE & PGSPT Coordinate the supply of payload-specific crew training materials for GSP training

Crew

GSP

TRAINING STRATEGY PROCESS

SE Conduct TIMs for each payload/exp to define crew training requirements

SE Conduct TST#1 for each payload/exp to status crew training requirements (I-24)

PTI Conduct TIMs to integrate crew training requirements for payload complement

PTI Status crew training requirements for the payload complement in an ITRR (I-19)

PGSPT Conduct TIMs for each payload/exp to define and integrate GSP training requirements

Sim Director Conduct Sim Working Group Meetings

PTI Conduct TST #2 to status crew, GSP and sim training requirements for the payload complement (I-14)

SE determines need to reevaluate a payload's/experiment's training requirements for future increments

MITP DEVELOPMENT

PTI Develop payload input to MITP based upon TST outputs, current PDL product, crew assignments, and crew job assignments

Input To MITP Preliminary (I -23)

Input To MITP Baseline (I-20)

Input To MITP Final Update (I-13)

ITI MITP Development

MITP I-22 I-19 I-12

PAYLOAD TRAINING SCHEDULE DEVELOPMENT

PTI Level IV Schedule - Payload Training

PTI Crew Training Schedule Development

PGSPT GSP Training

Simulation Director Simulations

SE Level V - Training Milestones

Crew & GSP Training Requirements

To Training Administration

From Top-Level Crew Training Schedules

To Simulation Planning & Verification and UDC Training Support

MITP from ITI

To/from Simulation Planning & Verification

GSP Requirements from TST Process

MTMP

NASA PTIP

PD Program Requirements

PAYLOAD DATA LIBRARY

TRAINING DATA SET

Crew Payload Training Curriculum

Crew Payload Training Hours

Payload Instructor Requirements

Payload Training Equipment Requirements

Payload-only Sims & Joint MST Requirements

GSP Training Requirements

To MITP Development

To Training Administration

PDC Site training Waiver, PDC Site Curriculum

SSTF/ PTC Simulator, SSTF/PTC Curriculum

SSTF/PTC Integrated Trainer Curriculum

Portable Training Equipment, Portable Training Curriculum

Stand-Alone Trainer, Stand-Alone Training Curriculum

SSMTF Trainer, SSMTF Training Curriculum

Neutral Buoyancy Lab Trainer, NBL Training Curriculum

Robotics Trainer, Robotics Training Curriculum

Simulation Types, Hours, & Objectives

TRAINING DEVELOPMENT & VERIFICATION

PDC

Payload Developer PTLP Development

PTLP delivery to SE RFT - 8 weeks

Payload Developer Training Courseware Development

Payload Developer Training Equipment Development

Training

Instructor

Payload Training Dry Run RFT -6 weeks

Trainer

Validated & Verified PODF/PDRP Inputs

GSP Training and Certification Plan

Training Input to Payload GSP Certification Process

Validated & Verified PODF/PDRP Inputs

PL INSTRUCTOR TRAINING & CERTIFICATION

PDC

SE/Crew Rep Certifies Instructor Readiness at PTDR

SSTF/PTC Integrated

Certified on payload by the following:
- Conducted PTDR
- Handover from certified payload instructor

Verified on PTC Facility Operations

Certified payload instructor or certified payload instructor team

SSTF/PTC Stand-alone

Certified on payload by the following:
- Conducted PTDR
- Handover from certified payload instructor

Verified on PTC Facility Operations

Certified payload instructor or certified payload instructor team

PAYLOAD TRAINING IMPLEMENTATION

CREW TRAINING

Basic Training (12 Months)

Advanced Training (12 months)

INCREMENT SPECIFIC TRAINING

Payload Science/Operations

Payload Transport

Payload Transfer

Payload Proficiency

Payload Refresher

Payload Complement

Integrated Payload-Only Simulations

Payload Participation In Joint MST

I-18 I-12 I-6 I-3

Payload Specific & PL-Only Simulation

Position Specific

Generic Ops

Crew Launch Window

On-Board Training

Crew Training Coordinator JIT Training

Crew Training Coordinator Payload Proficiency Training

Crew Training Coordinator Payload Refresher Training

POIC Cadre

Crew Training Coordinator Supports the Planning & Implementation of On-Board Training

Crew Training Coordinator Responds to Lessons Learned to Update Current Ground Training Implementation

Payload Developer

GSP TRAINING

Increment Specific GSP Instructors

EHS, USOC, UOF Readiness (I-12)

GSP Training Materials

Crew Training Materials

Payload Complement Launch Window

feedback to on-going training activities

SSTF/PTC Integrated

Simulation Engineer Payload Simulator Test Procedure Development

PSTP Shipment -2 Months

PUDG

Payload Developer SSTF/PTC Integrated Simulator Development

SE & PD Payload Simulator Preshipment Verification (Shipment -1 Mo)

Simulator Delivery to JSC (I-18 to I-15)

SE /PD /SSTF SME Payload Simulator Inventory & Interface Checkout

SE Payload Simulator Acceptance Test (Delivery +1 Mo)

Simulation Engineer/PD PTLP Development

PTLP due RFT -8 Weeks

Payload Developer Training Courseware Development

Training

Instructor

Payload Training Dry Run RFT -6 weeks

Verified Integrated Simulator

RFT (I-12)

Generic PSRD

Payload Developer Writes Trainer Development Specification

PDR/CDR (I-30/I-24)

Simulation Engineer PSRD Volume II Development with Support from Payload Developer

PSRD Volume II (I-18)

Simulation Engineer Lead PSRD Volume II Review

SSTF/PTC Standalone

Simulation Engineer Payload Simulator Test Procedure Development

PSTP Shipment -2 Months

PUDG

Payload Developer Stand-Alone Simulator Development

SE & PD Payload Simulator Preshipment Verification (Shipment -1 Mo)

Simulator Delivery to JSC (I-15 to I-13)

SE/PD/SSTF SME Payload Simulator Inventory & Interface Checkout

Simulation Engineer/PD PTLP Development

PTLP due RFT -8 Weeks

Payload Developer Training Courseware Development

Training

Instructor

Payload Training Dry Run RFT -6 weeks

Verified Simulator

RFT (I-12)

Generic PSRD

Payload Developer Writes Trainer Development Specification

PDR/CDR (I-30/I-24)

Simulation Engineer PSRD Volume II Development with Support from Payload Developer

PSRD Volume II (I-18)

Simulation Engineer Lead PSRD Volume II Review

Verified Simulators

PAYLOAD COMPLEMENT SIMULATOR VERIFICATION

Payload Complement Requirements Test (I-6)

Simulation Engineer PCRC Development

Payload Complement Requirements Checklist (I-8)

SSTF/PTC RFIT (I-6)

Verified Simulator Payload Complement

Certified Payload Training Equipment, Courseware & Lesson Plans

Simulation Scripts, Products, & Verified Packages / Interfaces

UDC Facility

Simulation Timeline Inputs

Portable

Payload Developer CBT, Training Videos, Training Manuals Development

Simulation Engineer Conduct PTDR (RFT- 6 Weeks) (Note: OBT has Different Template; see PTIP)

SSMTF

Payload Developer SSMTF Transfer Trainer Development

NBL

Payload Developer Will Work Requirements With MOD Personnel

ROBO

If Required, DX Will Develop Hardware/Software Models Using PDL Data

SIMULATION PLANNING & VERIFICATION

Payload Sim Guidelines Document

Increment Sim Supervisor Conduct Payload-Only Sim Working Group Meetings

I-12 to I-6

Sim Team Payload-Only Sim Script Development

Payload-Only Sim Scripts (sim - 4 wks)

Sim Team Payload-Only Sim Products Development

Payload-Only Sim Products (sim - 4 wks)

Increment Sim Sup Conduct Sim Check-out Activities (sim -2 months thru sim start)

I-6 to Crew Launch

Station Training Lead/Payload Sim Director Co-chairs JMSTWG Meetings

Payload Sim Team Develop Payload Inputs to JMST Scripts

Payload Script Inputs (prelim sim -8 wks final sim -2 wks)

Development of JMST Scripts

JMST Sim Scripts

Payload Sim Team Develop Payload Products for JMST

Payload Products (sim -2 wks)

Development of Products for JMST

JMST Sim Products

STL Conduct Sim Checkout Activities

From PDL

To/From Payload Training Schedule Development

UDC Training Support

From PDL

Simulation Engineer Data Stream Build Document Development

Data Stream Build Document (I-12)

Simulation Engineer UDC Payload Health & Status Data Stream

UDC Ready to Support Payload Complement Training (I-10)

☆ Represents the Processes and/or Tasks Which Will Just Be Performed For New Payloads/Exps or For Making Updates To Payload/Exp Requirements From Previous Flights. All Other Processes and/or Tasks Will Be Conducted Per Payload Complement.

FIGURE 5-1 PAYLOAD TRAINING PROCESS FLOW

and the payload complement. The hours estimated during the tactical planning process are also utilized by the PTI in helping define the Long Range Crew Training Schedule.

5.2 PAYLOAD TRAINING STRATEGY PROCESS

A NASA payload TST process has been defined to aid in the development of payload training requirements for crew and GSP for each specific payload or experiment and for complements of payloads/experiments. Using a team approach, the process will allow for inputs from the various groups of personnel responsible for some aspect of training, whether it be training management, curriculum or lesson development, PTU development, training delivery, training receipt, training support, simulation planning, simulation execution, or training administration. The official membership of the TST consists of MSFC training personnel, JSC training personnel, SSTF/PTC Subject Matter Experts (SME), PD Representatives, Crew Representatives, and Program Office personnel. Capitalizing on the broad knowledge base inherent in the team, the process will define a complete training strategy for each payload or experiment. For payload complements, the process will determine the objectives and schedules of Complement training, Payload-only Simulations, and payload involvement in JMST.

The NASA payload TST process will start when the payload or experiment becomes manifested by the Research Program Working Group (RPWG). Once begun, the full process consists of two phases of TIMs, each phase geared toward specific objectives. Each phase will be completed with a presentation to either the PTI or the Payload Training Panel (PTP), not for their approval, but to apprise the training community of the payload training plans for the complement. For reflights of payloads or experiments, the SE will determine when the TST process should start and exactly which meetings, if any, will be needed again for that payload or experiment.

Figure 5-2 shows the timeline of the NASA payload TST process. Phase 1 of the TST process, conducted for each new payload or experiment, will begin with a payload/experiment training overview then address crew training curriculum development, training tools development (including the definition of PTU requirements and schedule), and training readiness planning for that payload or experiment. Phase 1 for each payload and experiment should be completed by I-24 so this data may be entered by the PD into the Training Data Set and reflected on the Level V schedule created by the SE.

Phase 2 of the TST process will define the training requirements for both cadre and science team personnel, as well as the Payload Complement training for the crew. This phase specifically addresses crew participation in Payload Complement training, GSP participation in GSP training and GSP Payload-Only Simulations, crew and GSP participation in

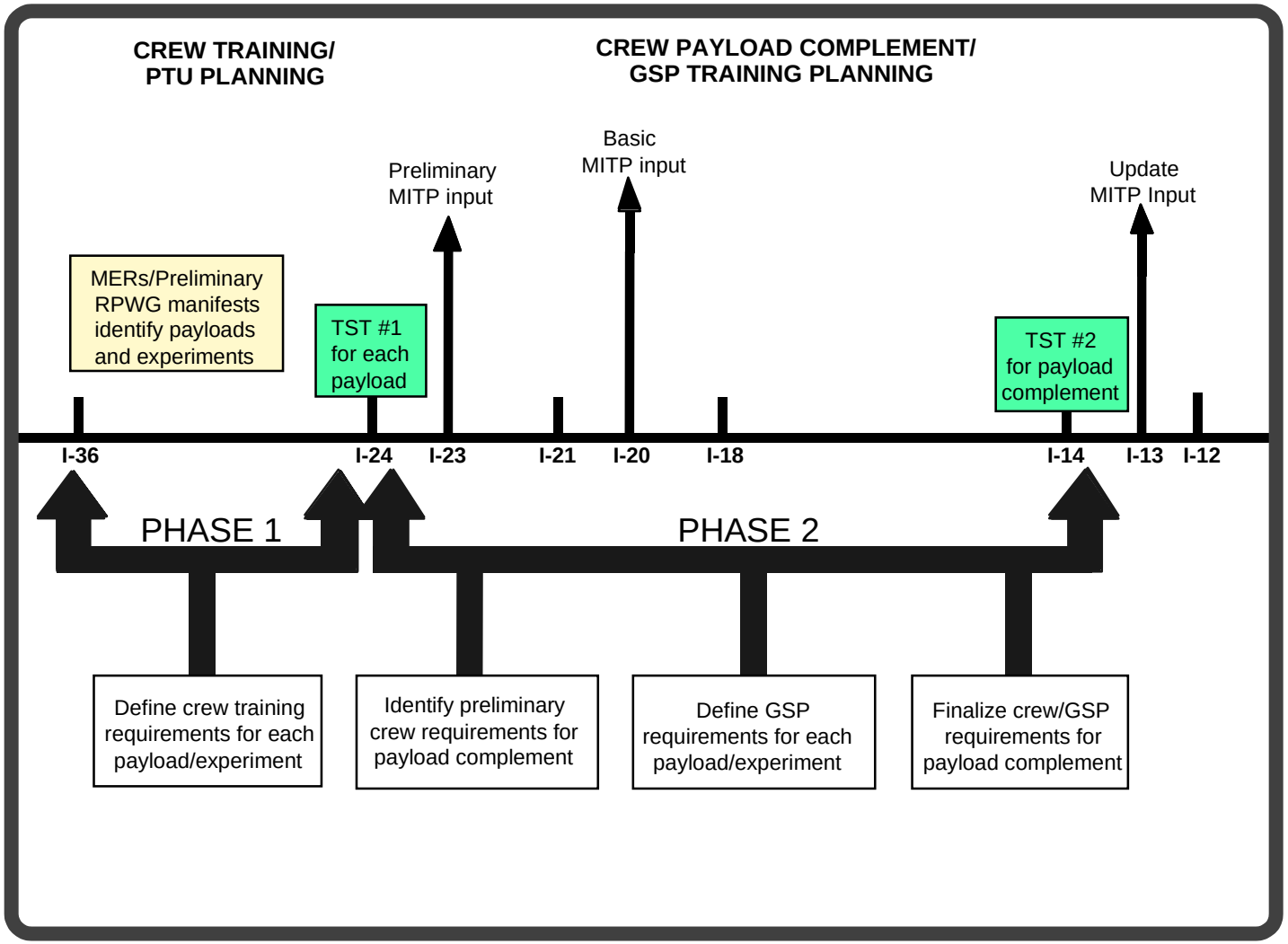

FIGURE 5-2 TRAINING STRATEGY TEAM PROCESS

Integrated Payload-Only Simulations, and also crew and GSP participation in JMSTs in which the payloads/experiments are involved. Phase 2 should be completed by I-14.

Each TIM or Simulation Working Group (SWG) meeting in the TST process will have different objectives, and each may have a unique group of attendees, based upon the task of the meeting. Appendix C provides detailed outlines of each TIM, SWG meeting, and TST meeting in the process. Each outline lists the title of the meeting, the objectives of the meeting, the chair of the meeting, the necessary attendees, the agenda, the responsible parties for agenda topics, and post-meeting activities and products. It should be noted that the TST process can and may be tailored for a specific payload or experiment; therefore, some TIMs may be combined and others may not be necessary at all.

During the course of the TST process, the PTI will also participate in the tactical planning process. The PTI will use the working manifest supplied by the RPWG for planning purposes. From the tactical planning process, the TST process will utilize the true payload complement manifest and the crew training hours documented in the IDRD.

Results of the NASA payload TST process will be documented in several ways and utilized in various other activities. Because of the ease of accessibility, the PDL will be used to store crew payload/experiment training curriculums, crew payload/experiment training hours including BDC, payload/experiment training equipment requirements, Payload-Only Simulation and JMST requirements, and GSP training requirements. All payload training requirements for crew and GSP, resulting from the two phases of the TST process, will be documented in the Training Data Set.

All crew and GSP payload/experiment training requirements will be passed to the appropriate personnel who implement the training. Other uses of TST results include the development of training equipment and lesson plans for use at a PDC (if waivered), the SSTF/PTC, and the SSMTF; the development of portable training equipment; the development of Level V schedule, which carries major simulator and training milestones; the development of simulation hours and objectives; and the development of a detailed Crew Training Plan.

5.3 MULTILATERAL INCREMENT TRAINING PLAN DEVELOPMENT

The PTI will oversee the development of the crew training payload portion of the MITP. The payload portion of this document will be assembled using detailed requirements gathered during the payload TST process and then documented in the Training Data Set.

Once crewmembers and job assignments are announced for a specific increment or flight, the PTI will utilize the information in the Training Data Set to define the detailed payload training requirements per crewmember. This payload training information will be

passed on to the ITI at I-20 so the ITI can include it in their Basic MITP due at I-19 (1 month prior to the start of Increment-Specific training).

Because of expected changes to the crew training plan after Increment-Specific training begins (i.e., standard EXPRESS payloads are manifested late in the flow, changes to the known payload complement, crew task assignment changes, etc.), a final crew payload training set of information is assembled and sent by the PTI at I-13 so the ITI can publish their Update MITP at I-12.

5.4 PAYLOAD TRAINING SCHEDULE DEVELOPMENT

Several different schedules will need to be created, maintained, and adhered to in order for everything to be ready for the start of crew payload training for a given set of crewmembers or GSP training. As can be seen in the Process Flow in Figure 5-1, several schedules will input data to the PTI's Level IV Schedule. This schedule is the "big picture" which includes milestones for such things as training requirements (e.g., PDL, TSTs, Inputs to MITP); training courseware/PTU development (e.g., hardware and software development/deliveries, CBT deliveries); training implementation (e.g., crew assignments, PDC training, PTC training); reference milestones (e.g., crew task assignments, POIC cadre assignment, GSP team definition). In addition to this schedule, the PTI will also create a Crew Training Schedule which will be provided to the PAYCOM for implementation.

The SE will create a Level V Schedule for each payload or experiment. This schedule will document delivery, testing, and certification milestones for integrated simulator hardware, CBTs, stand-alone trainers, and lessons. These milestones will need to be met by several people such as PDs, SEs, and SSTF/PTC personnel in order for ready-for-training dates to be met.

The Payload Simulation Director will create a Simulation Schedule for each increment. This schedule will include milestones for GSP Payload-Only Simulations, Integrated Payload-Only Simulations, and the payload portion of JMST.

The GSP Training Coordinators will create a GSP Training Schedule. This schedule will include milestones that GSP will need to meet in order to be certified to work an increment.

5.5 PAYLOAD TRAINING ADMINISTRATION AND IMPLEMENTATION

The PTI, in coordination with PDs, will use the products output from the planning, development, and verification activities previously described to effectively and efficiently integrate payload training for ISS crewmembers and GSP. Payload training administration and implementation will include daily coordination of schedules and agendas, execution of

training sessions, and training recordskeeping. The PTI will hand off these tasks to the PAYCOM and the GSP Training Coordinators. Training administration and implementation for crew and GSP will be discussed separately in the following subsections.

5.5.1 Crew Payload Training Administration and Implementation

The PAYCOM and PDs will be jointly responsible for coordinating daily schedules and agendas, executing crew training sessions, and tracking the performance of crew training. The following subsections discuss these three tasks.

5.5.1.1 Schedule Coordination and Agenda Development

The PD will coordinate with the PTI to ensure proper scheduling of the crew for training at the PDC if a waiver was obtained to do so. The PTI will coordinate the daily schedules with the CAM. The PD will be responsible for developing detailed agendas for training at their PDC.

For training sessions at the SSTF/PTC or the SSMTF, the PTI will coordinate with the PDs, Payload Instructors, the ITI, the CAM, the SSTF/PTC schedulers, and the SSMTF schedulers to schedule the crew, facility time, and resources. This activity will require integrating the needs and constraints of multiple crewmembers, crew sets, and GSP groups to achieve a coherent training schedule for the SSTF/PTC and the SSMTF. The PTI will be responsible for coordinating with the CAM and ensuring detailed agendas for payload crew training at the SSTF/PTC and the SSMTF are published the Thursday prior to the scheduled payload training.

Any crew payload training activities that are assigned to occur in the Advanced training phase will be scheduled independently of the increment-specific activities discussed above. The PTI will work with PDs and the CAM to define detailed weekly and daily schedules for advanced training on US payloads or experiments. The PTI will also provide a consolidated advanced payload training schedule input to the CAM for integration into the crew schedule.

5.5.1.2 Training Attendance Policy

A training attendance policy for crew payload training will be implemented for payloads/experiments and facilities in order to facilitate effective training delivery to all crewmembers. This policy should ensure a comfortable learning environment for all crewmembers, efficient use of training time, and minimize interruptions.

Attendance at crew payload training sessions will be limited to the following personnel: PAYCOM/Session Facilitator (mandatory), Trainee(s) (mandatory), Instructor(s)

(mandatory), Interpreter(s) (as required), SME(s) for the material presented (as determined by the PD and PTI), additional PAYCOMs (as required), PTI (invited), ITI (invited), JSC Payload Instructor (invited), and the Russian Training Manager (invited). All other personnel requesting to attend a crew training session must provide their name, position, and rationale to the PTI for the applicable increment. Training will only be accepted as a rationale if a valid training requirement was established through the TST process.

The PD will be consulted about training attendance, but the PTI will be the coordinator of payload training sessions and will assess all attendance requests. The PTI will need to know the names and purpose of all additional individuals requesting to attend training who are not listed above. This would also include any videotaping requests of the training session. Requests must be made at least 48 hours in advance of the training session to ensure that the PTI can properly assess the request. All non-crew personnel who are approved to attend training must do so on a non-interference basis (i.e., no interruption of the training session, no questions asked during the session). The session facilitator will be responsible for enforcing the attendance policy prior to and during a training session.

5.5.1.3 Crew Training Session Execution

Once a PDC training session is placed on the schedule, the PD will be responsible for ensuring all equipment, materials, and instructors are ready to support the scheduled session at their PDC. The PAYCOM will coordinate with the PD to make sure this task has been completed.

Once SSTF/PTC and/or SSMTF training sessions are placed on the schedule, the SE will coordinate with the PD's training representatives, the Payload Instructor, and the facility support personnel to ensure that the payload/experiment training equipment, support equipment, and training materials are in place for the training. The SE will also coordinate with the PD and the PODF team to ensure that the required payload operating procedures and displays are available for training. Note that the facility, resources, and personnel needed for each SSTF/PTC and/or SSMTF training session will be documented in the PTLP.

Training at the SSTF/PTC and/or SSMTF on a payload or experiment will be initially conducted by the PD's training personnel or by an SE serving as the PD's representative or a JSC Payload Instructor. This will occur until the payload/experiment configuration on board has stabilized and the training program has been successfully provided for at least one crew set. After that, the JSC Payload Instructors could be trained to take over the training for that payload or experiment for all subsequent crew sets if determined feasible and acceptable by the PD.

5.5.1.4 ISS Commander Training

In order to ensure that the ISS Increment Commander has cognizance of payload complement contents and safety, there will be a minimum set of requirements for ISS Commander payload training. Any training required in excess of the minimum will be a result of the agreed to Payload Qualifications and Responsibilities Matrix. Each Increment Commander will receive the following training:

A. The Increment Overview, which will contain a short summary of each payload and training requirements for the payload complement (given at I-18)

B. A Payload Complement Briefing/Handout (given at I-6), which will cover as a minimum:

(1) Payload Safety Summary

(2) Mission Planning Overview

(3) Stowage Overview

(4) Joint Operations Overview

(5) Payload Regulations

(6) LSE/PSE/SSE Resource Usage

(7) Lab and Rack Topology Overview

(8) Safing

(9) Ground Commanding

(10) Crew Access to Schematics

(11) Activation/Deactivation Requirements for Payloads

(12) Photo/TV Requirements

(13) PODF Contents

(14) Crew to Ground Interface

The Commander should also receive a Payload Transfer Plan, Delta Payload Summary (delta from the Increment Overview), a hardcopy of all Informed Consent

Briefings, an overall understanding of how payloads work (Payload Ops and Interfaces Training Manual), and Payload Emergency Procedures information.

5.5.1.5 Backup Crew Training

Per ISS Program direction, payload backup crew training will be provided to allow the increment to "hold to planned launch dates and not interrupt ISS assembly and fly safely". The backup crew can also prepare for their prime mission as applicable and may receive credit for training that applies to their prime mission. The backup training philosophy for payloads is intended to ensure safe transfer and installation of payloads. The minimum requirements for backup crew training will include:

A. Payload Increment Overview

B. Safety Overview

C. Payload Transfer and Transport Training

Additional backup training requirements will be determined on an increment-by-increment basis and could include individual payload overviews, payload nominal/mal operations, Payload Complement training, and the Informed Consent/BDC activities.

Factors which affect backup training include, but are not limited to: dedicated backup vs non-dedicated backup assignment, training facility availability, and training schedule availability. Backup training should be accounted for in the increment training plans and allocations. Records will be kept of training received by backup crews and proper credit given toward future increments when applicable.

5.5.1.6 Crew Training Recordskeeping

At the completion of training sessions held at a Payload Development Center (PDC), the PAYCOM will be responsible for providing an electronic, detailed payload training report. Training reports will define all payload/experiment training sessions which occurred, trainees in attendance, training objectives accomplished, and references to payload/experiment and payload complement training curriculum items which were completed during the training. The PAYCOM will ensure this training information is input into the Training Administration and Management System (TAMS) database which is maintained at JSC.

For training at the SSTF/PTC or SSMTF, the PAYCOM will be responsible for submitting an electronic training report via TAMS within 48 hours of training completion.

By utilizing and manipulating the information in TAMS, the PTI at any given time can obtain a report on the progress of each crewmember's training. The PTI will be responsible for providing a consolidated payload training input for the payload complement into the crew's certification process.

5.5.2 GSP Payload Training Administration and Implementation

PDs will be responsible for training their own GSP on all tasks and skills required to support payload operations on board the ISS. GSP training which must be coordinated across GSP and facilities/sites includes POIC interface training, Payload-Only Simulations, Integrated Payload-Only Simulations, and payload participation in JMST. The administration and implementation of such training includes coordination of schedules and agendas, distribution of courseware, execution of POIC interface training and simulations, and recordskeeping. The GTIs and GSP Training Coordinators will be responsible for these tasks. The GSP Training Coordinators will also work with each PD to gather and distribute any increment-specific crew training materials that may be used by other GSP for training.

During the TST process, all GSP requiring POIC interface training will be identified and then documented by the GSP Training Coordinators. This training will include, but not be limited to, the following topics:

A. POIC structure, functions, and products

B. Collection and distribution of digital, video, and voice data

C. A/G communications protocol

D. Standard Operating Procedures and Joint Operations and Integration Procedures

E. Command development, generation, and uplink

F. Payload Information Management System

This POIC interface training must be completed prior to I-12 in order to prepare GSP for participation in Payload-Only Simulations and JMST.

The GSP Training Coordinators will track the completion of POIC interface training and participation in Payload-Only Simulations and JMST by GSP. Training reports will be submitted to the GTI who is responsible for providing a consolidated payload training input for GSP into the GSP certification process.

SECTION 6, PAYLOAD TRAINING FACILITIES AND PTU DEVELOPMENT/ VERIFICATION/CERTIFICATION CYCLE

This section discusses the facilities/capabilities where payload training can be held (i.e., PDC, the SSTF/PTC, the SSMTF, the NBL, and the Robotics facility) and simulator verification that will need to occur before training commences. This section will also address the development and certification of lessons, Payload Instructors, and portable training materials.

6.1 PAYLOAD DEVELOPMENT CENTERS

The major functions of a PDC include the development of ISS payload flight hardware, software, and operational products to support peer-selected science in a specific scientific discipline. PDCs also serve as a centralized location for performing specific crew training objectives for ISS payloads and experiments. For a particular payload or experiment, the TST process will determine if there are specific crew training objectives which cannot be supported by training equipment at JSC. In these instances, the PD will submit a request for a waiver to the PCB via the PTP. If a waiver has been approved by the PCB, crewmembers may travel to PDCs to receive specialty skills training to meet these objectives.

In the event that crew training will occur at a PDC, the TST process will assist in the definition of requirements for developing and verifying training equipment, courseware, and lesson plans for this training. PDs will be responsible for the development of all training devices and courseware for PDC training. Six weeks prior to the training, the PD will perform a PTDR at the PDC. (NOTE: Schedule modifications may be made on a case-by-case basis to accommodate instructor travel needs.) The purpose of this review will be to perform a “dry run” of the crew training to certify all equipment, courseware, crew procedures, and instructors are ready for crew training. Although the PD, SE, JSC Payload Instructor, and Crew Representative can all attend the PTDR at the PDC, only the SE and crew representative are mandatory, as they officially certify the lesson. (See Appendix E for the complete PTDR process.) The PD will produce a PTLP for this training. The PTLP should be delivered to the SE 2 weeks prior to the PTDR at the PDC.

If a PDC is located at a primary training site, as defined in SPIP, Volume 7, a video conferencing capability could be utilized to support payload training. Crews will utilize this training capability to maintain proficiency and receive Refresher training on payloads or experiments when other training mediums are not available or do not sufficiently support the crew’s training needs. Video conference training will become especially important when crew travel limitations are imposed close to launch.

6.2 SPACE STATION TRAINING FACILITY/PAYLOAD TRAINING CAPABILITY

The SSTF/PTC is a strategic, permanent resource located at JSC in Building 5S. The SSTF/PTC was established with the purpose of providing full mission training of ISS crewmembers and GSP. The SSTF/PTC provides facilities, services, training equipment, and training units of ISS modules and of the ISS environment.

The PTC exists within the SSTF/PTC to provide the additional facilities and services required to support training of ISS crewmembers and GSP on the operation of US-sponsored payloads and experiments. The PTC provides the facilities for payload rack training units to be integrated into the U.S. Laboratory (U.S. Lab) or Secondary Lab (SLAB) and to interact with the SSTF's/PTC's ISS training units. The SSTF/PTC will also host stand-alone and table-top trainers that will not be integrated. Requirements for these trainers will be discussed separately below.

All hardware and software supplied by the PD shall remain in control of the PD, whereas all hardware and software supplied by the SSTF shall remain in control of the SSTF. Any issues regarding this subject matter should be identified, resolved, and documented by mutually acceptable agreement by representatives of both parties. Additional services requested by the User such as equipment modification, maintenance, and support should be negotiated through the formal SSTF Change Request Process.

6.2.1 SSTF/PTC Support for Integrated Payload Training Units

A PTU, which has been classified as an integrated rack or EXPRESS sub-rack, will be supported in two areas of the PTC: the U.S. Lab and the SLAB. Each area will provide resources and interfaces for an integrated PTU. The SLAB is intended for the initial integration of newly delivered PTUs and as an overflow training area for PTUs that are not part of the current increment. The U.S. Lab will generally be configured with the complement for the next increment to fly, which will be the current increment being trained. Refer to Appendix I of the PUDG for details on the SSTF/PTC facility layout and description.

Note that a Stand-Alone Payload Training Capability (SPTC) is being provided at the PTC for allowing integrated PTUs to be operated independently of the SSTF/PTC. This capability is not required to support stand-alone (or table-top) trainers which do not require SSTF/PTC interfaces to operate. Rather, the SPTC's purpose is to provide integrated PTUs with "substitute" SSTF/PTC interfaces to allow them to be used to provide individual payload/experiment training without tying up the SSTF/PTC computer system. The SSTF/PTC will provide a STEP and a STFx that will interface to the PTU in the same manner as the pre-shipment test configuration.

The resources and interfaces provided by the SSTF/PTC for an integrated PTU will include physical, electrical, thermal, data, and control. Figure 6-1 shows a block diagram of these interfaces and resources. These interfaces are defined in detail in the SSTF/PTC-to-payload simulator interface specifications given in Appendix III of the PUDG. Each PTC resource provided for integrating a PTU into the SSTF/PTC is described in the following list.

A. Physical. Each PTU will be integrated into the SSTF/PTC as an International Standard Payload Rack (ISPR) or equivalent, either provided by the SSTF/PTC or by the PD. The SSTF/PTC provides the rack interfaces by two complimentary interface panels, a standoff-mounted interface panel and an ISPR-Mounted Interface Panel (IIP). The SSTF/PTC-provided ISPRs are outfitted with the IIP as well as the Fire Detection System/maintenance switch panel and a fan assembly for rack ventilation. If the PD provides the rack, IIP and FDS/RMS panels will be provided.

B. Electrical. The SSTF/PTC facility provides electrical power and ground to each rack location supplying 120/208 Vac 3-phase power at 20 A. Any power conversion, for example to provide dc power, or control functions internal to the rack will be included as part of the PTU integrated rack provided by the PD.

C. Thermal. The SSTF/PTC facility includes a rack cooling system for each rack location that provides 2 kW of airflow heat dissipation per rack. Air inlets will allow cool ambient facility air into the internal volume of the rack for removal by duct fans (built into the standard ISPR racks). Although a 20-A circuit is provided, cooling and ventilation is provided for only 2 kW of power dissipation for each rack location. Any special cooling requirements will be included as part of the PTU provided by the PD.

D. Payload Ethernet Local Area Network (LAN) PEHG. The Ethernet connection provides the means for the PTU to replicate the data that is shipped into the flight C&DH system via the ISPR Ethernet connection.

E. MIL-STD-1553B Bus. The 1553 connection provides the means for the data to be shipped between the PTU and the flight C&DH system via the ISPR 1553 interface, including the low-rate housekeeping data.

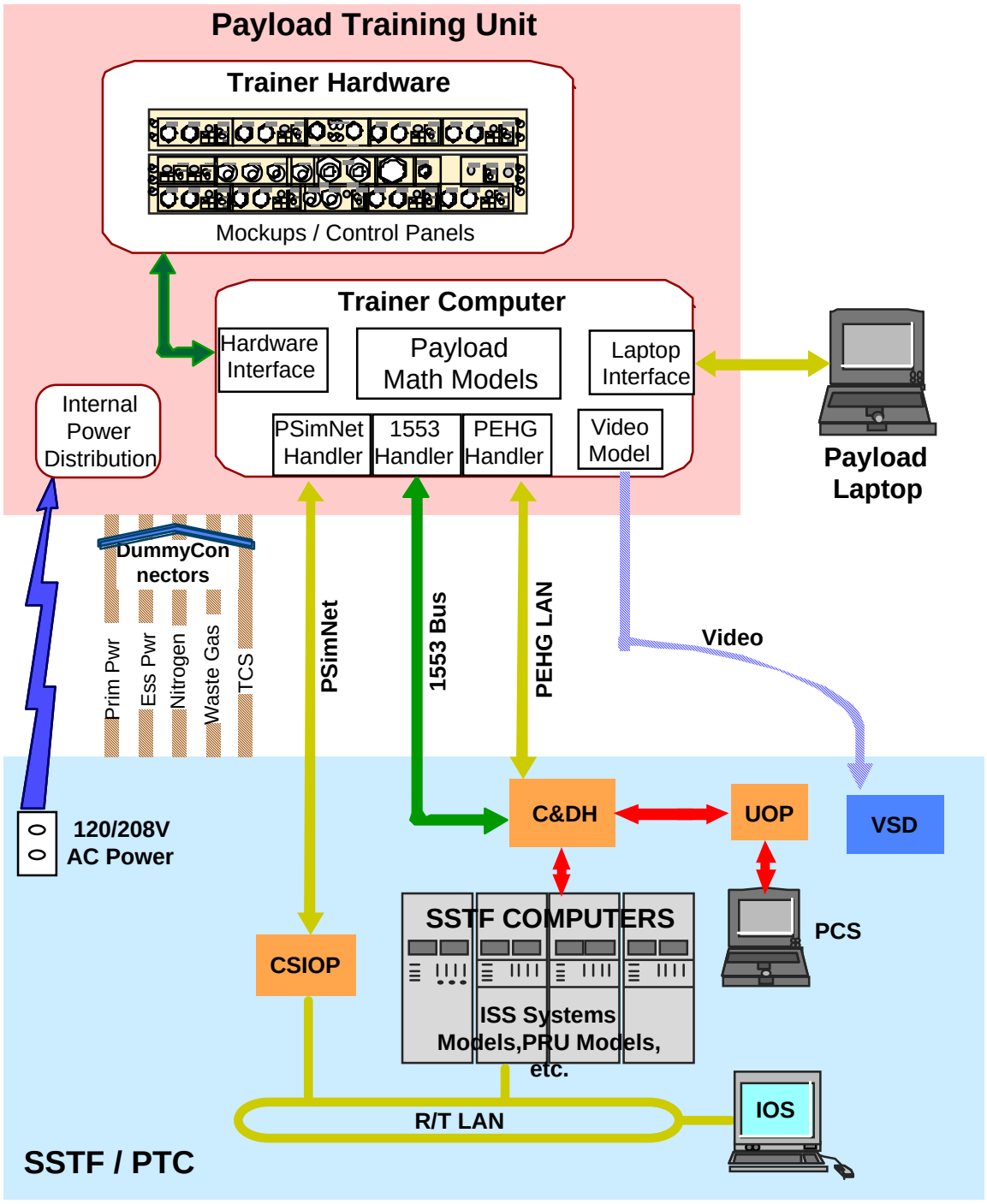

FIGURE 6-1 PTU INTERFACE BLOCK DIAGRAM

F. PSimNet. The PTU will interface with the SSTF/PTC for simulation unique control and data through the PSimNet Ethernet connection. This interface will provide the PTU with simulation control, including commands to initialize, control, and insert malfunctions into the PTU. The PSimNet also provides an interface between the simulator and the SSTF/PTC core systems simulators as detailed below.

G. PCS. The PCS is used to provide payload data and commanding capabilities from positions in the ISS other than the payload front panel or dedicated laptop computer. This computer is tied into the C&DH system via a 1553 interface or the PEHG LAN. The PCS will be loaded with the appropriate NASA-provided flight software for each increment.

H. Signal Conversion Equipment (SCE). The SCE provides for Input/Output (I/O) interfaces between the SSTF-provided equipment located at rack locations and the SSTF/PTC host system. Data types handled by the SCE include discrete inputs, discrete outputs, analog inputs, and analog outputs. I/O interfaces with payload simulator hardware are not supported by SCE.

I. Instructor/Operator Station (IOS). The IOS provides a means for controlling the PTU from a remote location while also controlling and monitoring the other payload and systems simulators. The IOS communicates with the PTU via the PSimNet for receiving data from and sending commands to the PTU.

J. Video Switching and Distribution (VSD) Subsystem. The VSD subsystem provides capabilities for routing video signals between the PTU and other training facilities. Connectors for National Television Standards Committee (NTSC) composite RS-170 video are available at each rack interface. Video generated by the PTU can be viewed in the SSTF/PTC at an IOS or on monitors in the briefing/debriefing rooms, or can be routed to other locations, including the MCC-H and the POIC.

Some flight-like utilities are not provided in the SSTF/PTC. These include 120 Vdc, 28 Vdc, cooling loops, nitrogen, and vacuum. PTUs shall be designed such that they do not require these utilities or shall internally derive these utilities from facility-provided interfaces. If necessary, training requiring the utilities not provided by the SSTF/PTC will be accommodated in other facilities at JSC such as the SSMTF.

The SSTF/PTC's ISS simulation contains high fidelity models to provide simulated resource support, provide environmental data, provide a simulation of the payload's computer interfaces, and to provide training for the crew and GSP on the interactions between ISS systems and payloads/experiments. For systems training when the PTU is not being used, the SSTF/PTC will use Payload Resource Utilization (PRU) models to provide a minimum set of data to simulate the load that the payload or experiment would place on the

core systems. The SSTF/PTC systems models are defined in detail in Section 4.5 of the PUDG, and are described briefly in the following list.

A. Environmental Control and Life Support System (ECLSS). The ECLSS includes the simulation of cooling air and heat loading at each ISPR location. The Lab Nitrogen System (LNS) consists of dummy N_2 lines and connectors for the PTU and simulation of the gaseous nitrogen flow rate to any ISPR location in the U.S. Lab module. The Vacuum System (VS) is a hardware and software simulation of the Vacuum Exhaust System and Vacuum Resource System.

B. Electrical Power System (EPS). The EPS provides a power status to the PTU for both the main bus power and the essential bus power available to the rack, including an emulation of the on-board utility outlet panels and a simulation of the power available to the payload.

C. Thermal Control System (TCS). The TCS consists of dummy coolant lines and connectors that will mate with the PTU and an internal active TCS that consists of the moderate temperature and low temperature payload rack flow control assemblies.

D. On-Board Computer System (OBCS). The OBCS provides a simulation of the ISS on-board C&DH system and its interface components. The OBCS supports ISS systems command and control, supports ISS payload users, and provides the services for flight crew and ground operations. The OBCS simulates the multiplexer/ demultiplexer, which provides data processing and transfer for the PTU. Since the OBCS includes the actual flight software, the data processing capabilities will duplicate those available on orbit, although downlink of the medium and high rate data is not supported. The interfaces between the PTU and the OBCS are provided through the Payload Ethernet LAN and the 1553 LAN.

E. Guidance, Navigation, and Control (GN&C). The GN&C simulates the flight GN&C system, providing the generation of state vectors, attitude, and pointing support data.

F. Communications and Tracking (C&T). The C&T provides the Acquisition of Signal/Loss of Signal (AOS/LOS) status for both the S-band and Ku-band. C&T supports all uplink and downlink capabilities with the exception of medium and high rate data. The interfaces supporting data uplink and downlink are provided via the OBCS simulation described above.

G. Environment (ENV). The ENV provides a software simulation of the ISS on-orbit environment. This simulation includes effects of gravity, solar sunrise/sunset and magnetic fields.

6.2.2 SSTF/PTC Support for Stand-Alone Trainers

A reduced level of SSTF/PTC facility requirements will apply to training equipment which will be brought, but not integrated, into the SSTF/PTC. This will include stand-alone trainers that are used for training in an off-line mode, training components that physically plug into an EXPRESS Rack, and hand-carried equipment which is brought in as needed to support training.

Stand-alone trainers for those payloads or experiments that do not require an integrated PTU will be supported in an off-line area of the PTC. This area will provide the required floor space and furniture to accommodate trainers. The SSTF/PTC will provide 120-Vac facility power and a heated/cooled environment for the trainers. Any other requirement will be negotiated with the SSTF/PTC.

6.2.3 Development/Verification/Certification of Integrated Payload Training Units

The template each integrated facility or sub-rack PTU must meet is shown in Figure 6-2 along with the personnel responsible for the various activities. **[TBR-1]** It is envisioned the cycle each PTU will follow starts with the PTU's development leading to its verification through testing, and ending with its certification that it can support all training objectives. Because so many PTUs will be sent to the SSTF/PTC, it is necessary to create windows for some of the activities to ensure not all PTUs will arrive at the same time. Training personnel will strive to schedule individual activities as early in each window as possible to ensure PTUs will be ready when needed for training. The following sections describe the development, verification, and certification activities that will be performed.

6.2.3.1 Development

Developers of payloads or experiments with a requirement to provide an integrated PTU to the SSTF/PTC will acquire their requirements from several sources. The initial requirement to provide a PTU will be based on the training classification of the payload/experiment, as described in Section 4.1 (Training Equipment), and the further recommendations from the TST process. Once the classification of a PTU has been decided, the PD will use the Generic PSRD, Volume 1 (and by reference the PUDG) to obtain the requirements their PTU must meet. General requirements all PTUs must meet are discussed in the beginning of the document followed by appendices of detailed requirements specific to

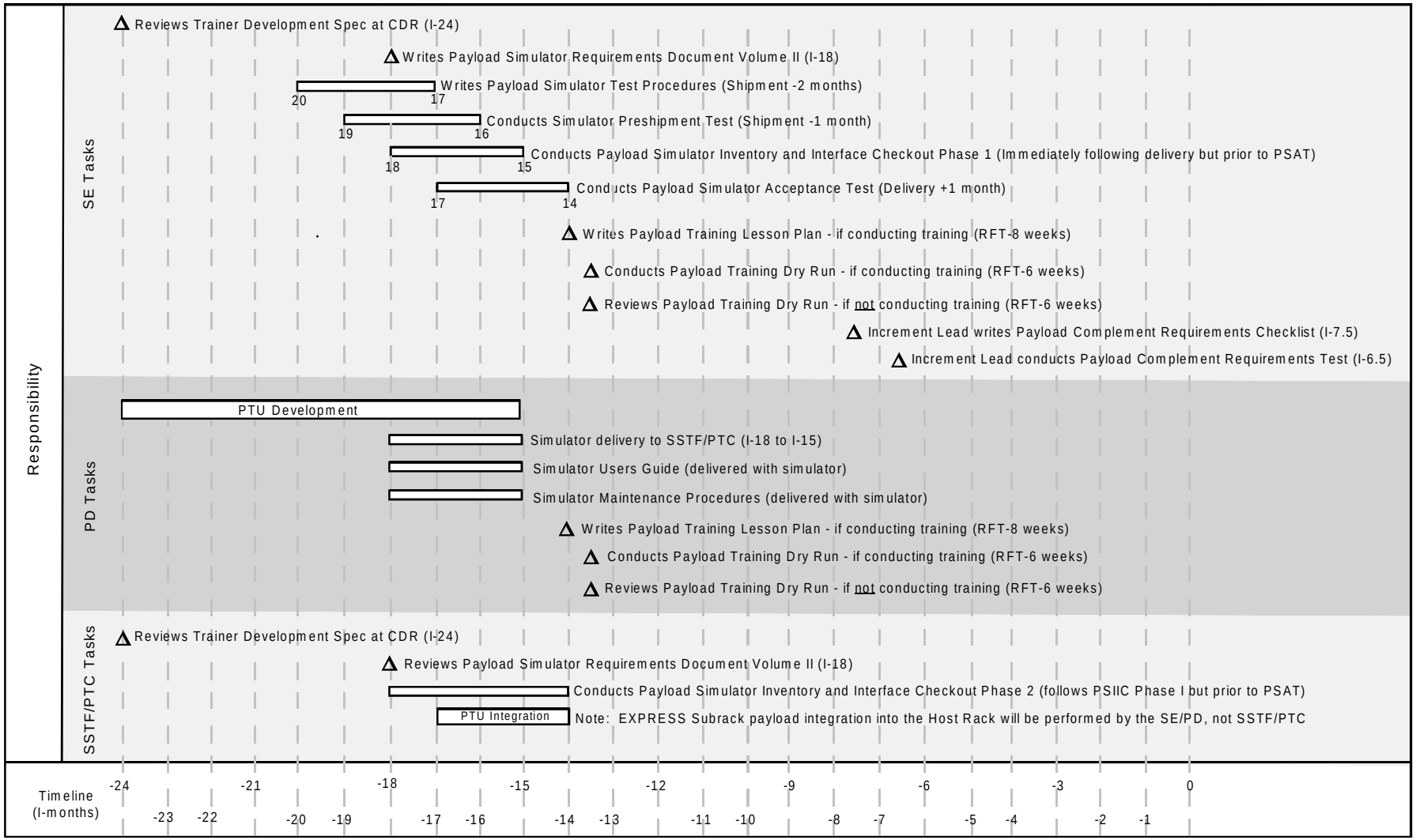

FIGURE 6-2 TEMPLATE FOR INTEGRATED PTU

integrated rack PTUs, EXPRESS sub-rack PTUs, stand-alone PTUs, EXPRESS Pallet PTUs, EXPRESS Pallet payload PTUs, and attached payload PTUs. The PD will write a Trainer Development Specification that details how their PTU will meet both the general and specific requirements defined in the Generic PSRD, Volume 1. The Trainer Development Specification will be included as part of the PD's PDR/CDR packages and reviewed by the SE, DT, and SSTF/PTC SMEs personnel. The purpose of the review by these various people is to ensure the PTU specified will meet both the training objectives and will work in the JSC training environment in which it will reside.

A PSRD, Volume 2 will be written by the SE no later than I-18. The purpose of this document is to compile PTU information JSC personnel will need in order to integrate the PTU properly. The types of information the SE will need to obtain from the PD and include in this document are as follows: a list of PD-provided components, a list of SSTF/PTC-provided components, a list of LSE/SSE requirements, unique 1-g support requirements, PTU configuration/layout diagram, PRU data, IOS display requirements, malfunction descriptions and flags, I/O data maps.

The PD will develop the PTU based on their Trainer Development Specification. Development of the PTU's SSTF/PTC interfaces shall be performed using the Simulator Test Fixture (STFx) and the Suitcase Test Environment for Payloads (STEP), provided by the Program Office at some cost, which provide a portable SSTF/PTC interface "surrogate." PDs developing PTUs to be integrated into an EXPRESS Rack will use the Suitcase Simulator for EXPRESS (ScS-E) instead of the STFx and STEP.

6.2.3.2 Testing

PTU delivery will occur between I-18 to I-15. Because facility PTUs will be more complex, they will be expected early in the window whereas sub-racks could be later. One month prior to delivering the PTU to the SSTF/PTC, the PD will host the SE to conduct a Pre-Shipment Test. The purpose of this test is to ensure that the PTU meets the operational and interface requirements contained in the Trainer Development Specification as well as the training objectives decided upon during the TST process. The test will be conducted using the applicable portions of the Payload Simulator Test Procedure written by the SE. The test will be conducted with the PTU integrated with the STFx and the STEP (or the ScS-E if an EXPRESS payload) to provide an end-to-end verification of the simulator's interfaces. Problems encountered during the Pre-Shipment Test will need to be corrected by the PD prior to shipping the PTU to the SSTF/PTC.

The PD will be responsible for crating and shipping to the SSTF/PTC the PTU as specified in the PUDG. The shipment should include the PTU User's Guide and the PTU Maintenance Procedures per the PUDG, as well as all hardware and software required. Those

components of the PTU which are considered “hand-carried” (e.g., those nonintegrated components that have other uses or that are expendables), will be delivered to the SSTF/PTC at least 24 hours prior to any testing or training sessions. The configuration and installation of the PTU components will be as detailed in the PUDG. Any payload-specific installation instructions will be included in the Simulator Users Guide.

A PSIIC will be performed at the SSTF/PTC soon after the PTU is received. For a PTU that will be integrated into the SSTF/PTC, the PSIIC shall occur in two phases:

A. The objectives of phase one of the PSIIC are to verify that all PTU components expected were received, that no damage occurred to the PTU during shipment, and the PTU still works. The inventorying and limited checkout will be conducted using the applicable portions of the PSTP written by the SE. The test shall be performed by a team consisting of the SSTF/PTC personnel, SE, and PD with suggested participation by the JSC Payload Instructor. In phase two, a further checkout of the integration and operations of the simulator is required.

B. The objectives of phase two are to verify that all PTU components’ interface requirements have been met and to test those interfaces prior to installation and interface with the SSTF/PTC systems. An integrated rack PTU shall be connected to a GFE STFx and a STEP, and a test procedure written by SSTF/PTC personnel will be run. Phase two of the PSIIC will be performed by SSTF/PTC personnel with possible participation by SE and PD. Similarly, an integrated EXPRESS sub-rack payload will be tested by the SE and PD by connecting to an ScS-E, and a pallet payload will be connected to a ScS-EP.

A PTU that consists of integrated racks shall be installed into the SSTF/PTC by SSTF/PTC personnel on a schedule defined by the SE which will define when the PTU is moved from the Rack Buildup Area (RBA) to the U.S. Lab or SLAB. Integrated EXPRESS sub-rack PTUs will be installed into their host racks, wherever they may be located, by the SE and PD after which SSTF/PTC personnel will install the integrated rack into the SSTF/PTC. Simulator-specific installation requirements and procedures will be provided in the Simulator Users Guide. Once a PTU has been accepted and integrated into the SSTF/PTC, and SSTF/PTC personnel are satisfied with the integration, the SE will be responsible for scheduling and performing a final verification. This verification provides a systematic process to ensure that the PTU has been integrated into the SSTF/PTC as specified in the PUDG and works properly with other ISS system models. The test is called a Payload Simulator Acceptance Test (PSAT).

A month after delivery, a PSAT will be performed for all integrated PTUs. The PSAT will be performed using the applicable portions of the PSTP written by the SE. The PSAT will be conducted by the SE with support required from SSTF/PTC personnel and the PD.

JSC Payload Instructors are encouraged to attend. The objective of the PSAT is to verify that the PTU, once integrated with the SSTF/PTC systems, meets the requirements defined in the PSRD, Volumes 1 and 2. Examples of items to be tested are the IOS interfaces and displays, simulator moding, health and status data validity and limit sensing, PCS interfaces, interfaces to ISS core system models, and malfunction control.

At I-6, a PCRT will serve as a final verification that the entire U.S. Lab complement of payloads, experiments, support equipment, and ISS systems are ready to support training. This event will be chaired by the Increment Lead SE with required attendance of the SEs for all payloads, experiments, support equipment, and ISS systems in the complement. SSTF/PTC personnel will be required to support this event. PDs are normally not associated with this test. This test will use the verification procedures provided in the PCRC. Once the PCRT is completed, the integrated complement will be certified that it reflects the actual increment complement of payloads, experiments, and support equipment, and that all SSTF/PTC interfaces operate correctly in the integrated environment. Note that the PCRT can be conducted in parallel with the Trainer Qualification Test (TQT) performed by SSTF/PTC personnel.

6.2.3.3 Certification

Six weeks prior to crew training, the PTDR will be performed to certify that the PTU and all support systems, courseware, and instructors are ready to support a particular training lesson. Every lesson taught to the crew will go through this dry run process. The PTDR will be conducted by whatever instructor has been designated to conduct the training for the crew. Attendance will be required by the responsible SE and a crew representative as they are the two people who sign-off and certify lessons, but JSC Payload Instructors should attend. Support from SSTF/PTC personnel may be required. The PTLP (written by whoever is doing the initial instructing) will be utilized. Once the PTDR has been satisfactorily completed and signed off by the SE and crew representative, that lesson and all hardware, software, courseware, and instructors used during the lesson becomes certified and stays certified until there is a major change made. (The complete PTDR process can be found in Appendix E of this document). Note that a TQT may be performed by SSTF/PTC personnel to verify the overall training readiness of the SSTF/PTC simultaneously with the PTDR on a non-interference basis.

6.2.3.4 Maintenance and Return

PD training personnel, or the SE acting on their behalf, will provide maintenance, sustaining engineering, and post-training support of the PTU as detailed in Section 3.1 of the PUDG. SSTF/PTC personnel will provide the routine maintenance activities required by the PTU, provided they are defined in the PTU Maintenance Procedures. Any special

maintenance activities required of SSTF/PTC personnel will be negotiated and documented in the PTU Maintenance Procedures. Once the training requirements for the PTU have been fulfilled, packing and shipping of the simulator will be performed by the PD as detailed in Section 3.1 of the PUDG.

6.2.4 Development/Verification/Certification of Stand-Alone Payload Training Units

The template each stand-alone PTU must meet is shown in Figure 6-3 along with the personnel responsible for the various activities. [TBR-1] The template for stand-alone PTUs is very similar to that of integrated PTUs. It is envisioned the cycle each PTU will follow starts with the PTU's development leading to its verification through testing, and ending with its certification that it can support all training objectives. Because so many PTUs will be sent to the SSTF/PTC, it is necessary to create windows for some of the activities to ensure not all PTUs will arrive at the same time. Training personnel will strive to schedule individual activities as early in each window as possible to ensure PTUs will be ready when needed for training. The following sections describe the development, verification, and certification activities that will be performed.

6.2.4.1 Development

Developers of payloads or experiments with a requirement to provide a stand-alone PTU to the SSTF/PTC will acquire their requirements from several sources. The initial requirement to provide a PTU will be based on the training classification of the payload/experiment, as described in Section 4.1 (Training Equipment), and the further recommendations from the TST process. Once the classification of a PTU has been decided, the PD will use the Generic PSRD, Volume 1 (and by reference the logistics portion of the PUDG) to obtain the requirements their PTU must meet. General requirements all PTUs must meet are discussed in the beginning of the document followed by appendices of detailed requirements specific to integrated rack PTUs, EXPRESS sub-rack PTUs, stand-alone PTUs, EXPRESS Pallet PTUs, EXPRESS Pallet payload PTUs, and attached payload PTUs. The PD will write a Trainer Development Specification that details how their PTU will meet both the general and specific requirements defined in the Generic PSRD, Volume 1. The Trainer Development Specification will be included as part of the PD's PDR/CDR packages and reviewed by the SE, DT, and SSTF/PTC SMEs personnel. The purpose of the review by these various people is to ensure the PTU specified will meet both the training objectives and will work in the JSC training environment in which it will reside. The PD will develop the PTU based on their Trainer Development Specification.

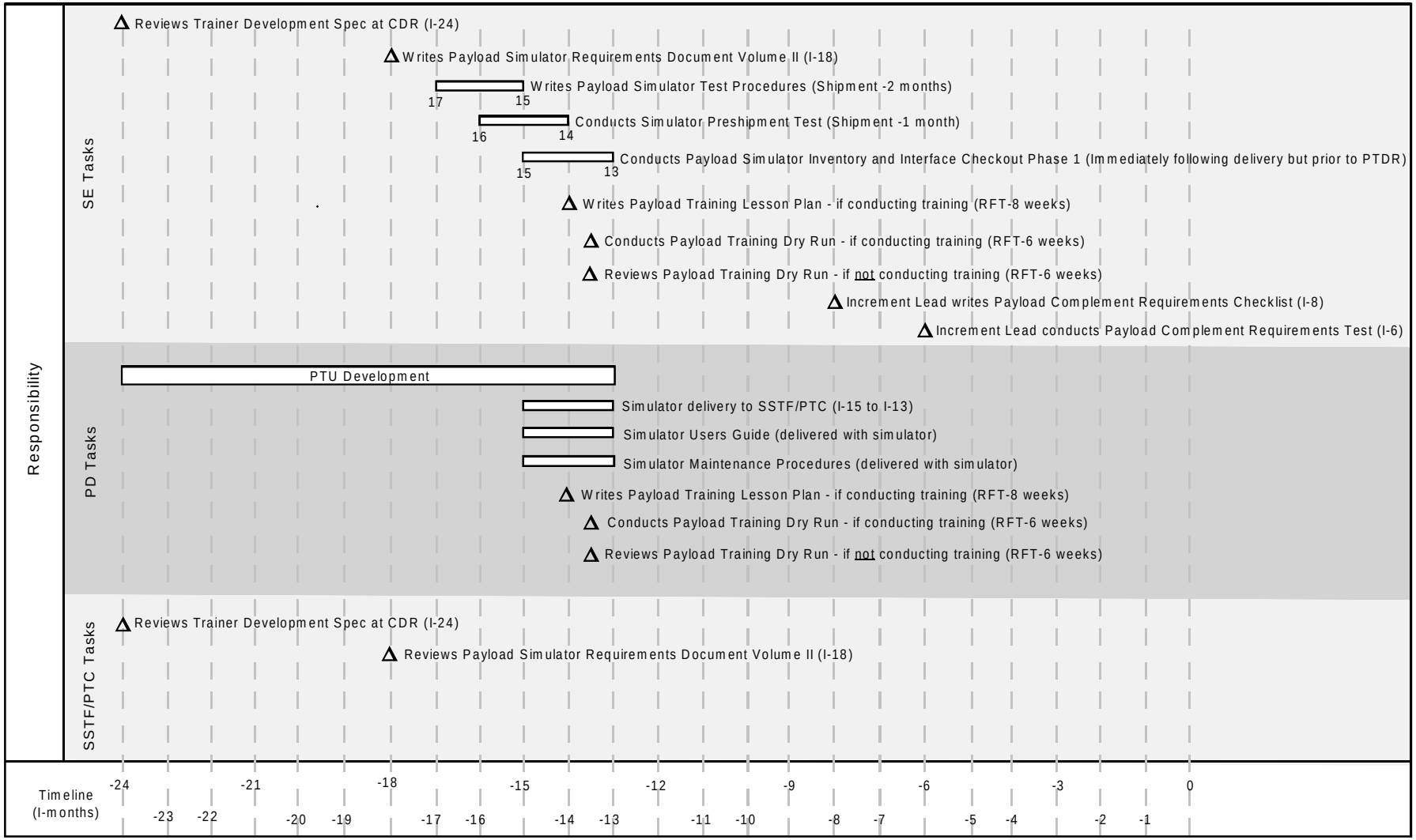

FIGURE 6-3 TEMPLATE FOR STAND-ALONE PTU

A PSRD, Volume 2 will be written by the SE no later than I-18. The purpose of this document is to compile PTU information JSC personnel will need in order to use the PTU properly. The types of information the SE will need to obtain from the PD and include in this document are as follows: a list of PD-provided components, a list of SSTF/PTC-provided components, a list of LSE/SSE requirements, unique 1-g support requirements, PTU configuration/layout diagram, PRU data, and malfunction descriptions.

6.2.4.2 Testing

PTU delivery will occur between I-15 to I-13. One month prior to delivering the PTU to the SSTF/PTC, the PD will host the SE to conduct a Pre-Shipment Test. The purpose of this test is to ensure that the PTU meets the operational and interface requirements contained in the Trainer Development Specification as well as the training objectives decided upon during the TST process. The test will be conducted using the applicable portions of the Payload Simulator Test Procedure written by the SE. Problems encountered during the Pre-Shipment Test will need to be corrected by the PD prior to shipping the PTU to the SSTF/PTC.

The PD will be responsible for crating and shipping to the SSTF/PTC the PTU as specified in the PUDG. The shipment should include the PTU User's Guide and the PTU Maintenance Procedures per the PUDG, as well as all hardware and software required. Those components of the PTU which are considered "hand-carried" (e.g., those nonintegrated components that have other uses or that are expendables), will be delivered to the SSTF/PTC at least 24 hours prior to any testing or training sessions. The configuration and installation of the PTU components will be as detailed in the PUDG. Any payload-specific installation instructions will be included in the Simulator Users Guide.

A PSIIC will be performed at the SSTF/PTC soon after the PTU is received. For a PTU that will be stand-alone, only Phase 1 of the PSIIC will occur.

A. The objectives of phase one of the PSIIC are to verify that all PTU components expected were received, that no damage occurred to the PTU during shipment, and the PTU still works. The inventorying and limited checkout will be conducted using the applicable portions of the PSTP written by the SE. The test shall be performed by the SE and PD if desired with possible participation required by SSTF/PTC personnel and suggested participation by the JSC Payload Instructor.

6.2.4.3 Certification

Six weeks prior to crew training, the PTDR will be performed to certify that the PTU and all support systems, courseware, and instructors are ready to support a particular training

lesson. Every lesson taught to the crew will go through this dry run process. The PTDR will be conducted by whatever instructor has been designated to conduct the training for the crew. Attendance will be required by the responsible SE and a crew representative as they are the two people who sign-off and certify lessons, but JSC Payload Instructors should attend. Support from SSTF/PTC personnel may be required. The PTLP (written by whoever is doing the initial instructing) will be utilized. Once the PTDR has been satisfactorily completed and signed off by the SE and crew representative, that lesson and all hardware, software, courseware, and instructors used during the lesson becomes certified and stays certified until there is a major change made. (The complete PTDR process can be found in Appendix E of this document).

6.2.4.4 Maintenance and Return

PD training personnel, or the SE acting on their behalf, will provide maintenance, sustaining engineering, and post-training support of the PTU as detailed in Section 3.1 of the PUDG. SSTF/PTC personnel will provide the routine maintenance activities required by the PTU, provided they are defined in the PTU Maintenance Procedures. Any special maintenance activities required of SSTF/PTC personnel will be negotiated and documented in the PTU Maintenance Procedures. Once the training requirements for the PTU have been fulfilled, packing and shipping of the simulator will be performed by the PD as detailed in Section 3.1 of the PUDG.

6.2.5 Payload Training in the SSTF/PTC

The SSTF/PTC will be the primary site for crew payload training to minimize crew travel and maximize the commonality of training equipment from one increment to the next. The SSTF/PTC lab mockups provide the only capability to train a complement of payloads/experiments interfacing to the ISS support systems and the ground support elements (e.g., the SSCC, POIC, or TSCs); therefore, crew training objectives that involve integrated ISS operations or incorporate ground support elements shall be conducted from the SSTF/PTC. Payload training planned for the SSTF/PTC is intended to satisfy the following top-level training objectives:

A. Nominal and off-nominal crew operations of individual payloads or experiments

(1) Activation/deactivation of payload/experiment

(2) Control and monitoring of payloads/experiments (by front panels, laptops, PCS displays, etc.) for science acquisition

(3) Logistics involving physical items (sample exchanges and transfers, equipment hookup)

(4) Detection and response to off-nominal conditions

(5) Crew hazards and safety awareness, procedures, and constraints

B. Crew operations of multiple payloads or experiments in an integrated environment

(1) Activation/deactivation of payloads, experiments, and systems

(2) Monitoring of payloads, experiments, and systems (by front panels, laptops, PCS displays)

(3) Logistics involving physical items (sample exchanges and transfers, equipment hookup)

C. Interactions between payloads, experiments and ISS subsystems and/or payloads/experiments and the host rack

D. Data, commands, video, and voice interfaces with the ground control centers, including effects of communication outages

E. Using integrated products (On-board Short-Term Plan, Electronic Procedures, Inventory Management System, etc.)

F. Rapid safing procedures, integrated payload safety concerns, emergency drills

G. Photographic and television activities for payload/experiment support

H. Stowage and Inventory Management Systems support for payloads and experiments

I. Interfaces between payloads, experiments, and LSE

J. Compatibility assessment of payload complement (logistics, physical constraints, time constraints, etc.)

6.3 SPACE STATION MOCKUP TRAINING FACILITY

The SSMTF is a strategic, permanent resource located at JSC in Building 9. The SSMTF provides the crew and GSP with a facility to train microgravity activities in a 1-g environment, payload-specific operations that require the rotation of a rack or the extension of pullouts, and experiment unique operations needing water, N_2, power, and vacuum. The SSMTF provides facilities, services, generic training equipment, and physical mockups of transport vehicles and ISS modules.

All hardware and software supplied by the PD shall remain in control of the PD. All hardware and software supplied by SSMTF shall remain in control of SSMTF. All issues regarding this subject matter should be identified, resolved, and documented by mutually acceptable agreement by representatives of both parties in the Facility Utilization Request (FUR) form found in SHI-SVMF-M0002, Space Vehicle Mockup Facility (SVMF) User's Manual. Additional services requested by the user such as equipment modification, maintenance, and supports should be negotiated through the formal SVMF Change Request (CR) process.

6.3.1 Development/Verification/Certification of a PTU

It is envisioned the cycle each PTU will follow starts with the PTU's development leading to its verification through testing, and ending with its certification that it can support all training objectives. The following sections describe these activities.

6.3.1.1 Development

PDs with a requirement to provide a PTU for payload or experiment-unique operations at the SSMTF will acquire their requirements from several sources. The initial requirement to provide a trainer will be based on the training classification of the payload/experiment, as described in Section 4.1 (Training Equipment), and the further recommendations from the TST process. Generic as well as detailed requirements for the trainer are documented in the Generic PSRD, Volume 1 (and by reference the SSMTF Payload Interface Control Document for the Payload Development Laboratory, Flight Crew Support Laboratory, and Centrifuge Accommodation Module. The PD will write a Trainer Development Specification that details how their PTU will meet both the general and specific requirements defined in the Generic PSRD, Volume 1. The Trainer Development Specification will be included as part of the PD's PDR/CDR packages and reviewed by the SE and SSMTF personnel. The purpose of the review by these various people is to ensure the PTU specified will meet both the training objectives and will work in the JSC training environment in which it will reside. The PD will develop the PTU based on their Trainer Development Specification.

A PSRD, Volume 2 will be written by the SE no later than I-18. The purpose of this document is to compile PTU information JSC personnel will need in order to integrate the PTU properly. The types of information the SE will need to obtain from the PD and include in this document are as follows: a list of PD-provided components, a list of SSMTF-provided components, a list of LSE/SSE requirements, unique 1-g support requirements, PTU configuration/layout diagram, and malfunction descriptions.

6.3.1.2 Testing

PTU delivery will occur between I-18 to I-15. One month prior to delivering the PTU to the SSMTF, the PD will host the SE to conduct a Pre-Shipment Test. The purpose of this test is to ensure that the PTU meets the operational and interface requirements contained in the Trainer Development Specification as well as the training objectives decided upon during the TST process. The test will be conducted using the applicable portions of the Payload Simulator Test Procedure written by the SE. Problems encountered during the Pre-Shipment Test will need to be corrected by the PD prior to shipping the PTU to the SSMTF.

The PD will be responsible for crating and shipping to the SSMTF the PTU. The shipment should include the PTU User's Guide and the PTU Maintenance Procedures, as well as all hardware and software required. Those components of the PTU which are considered "hand-carried" (e.g., those nonintegrated components that have other uses or that are expendables), will be delivered to the SSMTF at least 24 hours prior to any testing or training sessions. Any payload-specific installation instructions will be included in the Simulator Users Guide.

A PSIIC will be performed at the SSMTF soon after the PTU is received. For a PTU that will be located at the SSMTF only Phase 1 of the PSIIC will occur.

A. The objectives of phase one of the PSIIC are to verify that all PTU components expected were received, that no damage occurred to the PTU during shipment, and the PTU still works. The inventorying and limited checkout will be conducted using the applicable portions of the PSTP written by the SE. The test shall be performed by the SE and PD if desired with possible participation required by SSMTF personnel and suggested participation by the JSC Payload Instructor.

A PTU that consists of integrated racks shall be installed into the SSMTF by SSMTF personnel. Simulator-specific installation requirements and procedures will be provided in the Simulator Users Guide. Once a PTU has been accepted and integrated into the SSMTF, and SSMTF personnel are satisfied with the integration, the SE will be responsible for scheduling and performing a final verification. This verification provides a systematic process to ensure that the PTU has been integrated into the SSMTF as specified and works properly. The test is called a Payload Simulator Acceptance Test (PSAT).

A test readiness review may be required for new and/or unusual activities. Prior to each test involving mockups, trainers, and test equipment considered hazardous and not previously used in PDL activities, a Test Readiness Review Board (TRRB), chaired by the Test Operations Manager or designee, will be conducted. Such review will be in accordance with JSC-26830, SVMF General Operating Procedures, to determine readiness for a

scheduled test or training activity to be performed. TRRs will also be conducted in accordance with JPG 1700.1H, JSC Safety and Health Handbook.

A month after delivery, a PSAT will be performed. The PSAT will be performed using the applicable portions of the PSTP written by the SE. The PSAT will be conducted by the SE with support required from SSMTF personnel and the PD. JSC Payload Instructors are encouraged to attend. The objective of the PSAT is to verify that the PTU, once integrated within the SSMTF, meets the requirements defined in the PSRD, Volumes 1 and 2.

6.3.1.3 Certification

Six weeks prior to crew training, the PTDR will be performed to certify that the PTU and all support systems, courseware, and instructors are ready to support a particular training lesson. Every lesson taught to the crew will go through this dry run process. The PTDR will be conducted by whatever instructor has been designated to conduct the training for the crew. Attendance will be required by the responsible SE and a crew representative as they are the two people who sign-off and certify lessons, but JSC Payload Instructors should attend. Support from SSMTF personnel may be required. The PTLP (written by whoever is doing the initial instructing) will be utilized. Once the PTDR has been satisfactorily completed and signed off by the SE and crew representative, that lesson and all hardware, software, courseware, and instructors used during the lesson becomes certified and stays certified until there is a major change made. (The complete PTDR process can be found in Appendix E of this document).

6.3.1.4 Maintenance and Return

PD training personnel, or the SE acting on their behalf, will provide maintenance, sustaining engineering, and post-training support of the PTU. SSMTF personnel will provide the routine maintenance activities required by the PTU, provided they are defined in the PTU Maintenance Procedures. Any special maintenance activities required of SSMTF personnel will be negotiated and documented in the PTU Maintenance Procedures. Once the training requirements for the PTU have been fulfilled, packing and shipping of the simulator will be performed by the PD.

6.3.2 Payload Training in the SSMTF

For ISS payloads and experiments, the SSMTF will be used primarily for training the crew on transfer operations, those operations involved in moving payload elements from the transport vehicle (e.g., Shuttle, Soyuz, Mini-Pressurized Logistics Module) to the ISS. The SSMTF will also serve as the training facility for some ISS payload operations that cannot be

accomplished at the SSTF/PTC due to its limitations. The resources and interfaces provided by the SSMTF for payload training include physical, electrical, N_2, vacuum, water, rack rotation, and the full extension of pullout hardware, and are defined in detail in the specifications given in the SSMTF Payload Interface Control Document.

The ISS or Shuttle crew that is tasked to perform the transfer operations will be trained on the generic transfer operations (i.e., transferring racks and drawers) by systems training personnel as part of their Advanced training. Training on payload/experiment-specific transfer operations will be provided during the Increment-Specific training phase. Payload/experiment-specific transfer operations include those requiring special deintegration and integration tasks, those involving special handling of the payload equipment, and those involving emergency and safety issues. Payload/experiment-specific transfer training will be the responsibility of the PTI.

The training that will take place at the SSMTF is intended to satisfy the following training objectives:

A. Crew operations involved in transferring payloads and experiments between the transport vehicle and the ISS

   (1) Deactivation/reactivation of payload/experiment (training on this may be accomplished on the integrated simulator in the SSTF/PTC)

   (2) Demating/mating of payload/experiment-specific connections to the transport vehicle or ISS systems

   (3) Payload/experiment-specific logistics involving transferring physical modules between vehicles

B. Using integrated products, e.g., On-board Short-Term Plan, Electronic Procedures during transfer operations

C. Safing procedures, payload/experiment safety concerns, or handling of hazardous materials during transfer operations

D. Crew operations involved in rotating or tilting a rack

E. Crew operations involved in fully extending pieces of hardware

F. Connecting and utilizing resources such as water, N_2, vacuum, etc.

G. Training with live biological specimens **[TBR-2]**

H. Training human-in-the-loop experiments and related hardware.

6.4 NBL TRAINING FACILITY

Those payload-specific operations that require crew Extra-Vehicular Activity (EVA) may require the development of payload/experiment-specific hardware for EVA training in the NBL located at JSC as determined by the TST. Only if payload- or experiment-unique requirements exist, does hardware have to be built. Requirements for the hardware are to be documented in PDL. The PD is responsible for the production and delivery of this mock-up hardware to the NBL in coordination with Mission Operations Directorate (MOD) personnel as specified in the NTIP and the NBL guide.

6.5 ROBOTICS TRAINING FACILITY

Those payload/experiment-specific operations that require crew use of the ISS or Shuttle Remote Manipulator arms (e.g., attached payload transfer, Pallet payload installation, etc.) may require the development of payload/experiment-specific hardware for robotics training in the MRMDF as determined by the TST. This hardware consists of a volumetrically representative, light-weight model (balloon). The PD will notify DX personnel that a robotics training requirement exists for the payload. DX personnel will write the requirements for the balloons to be used in the MRMDF. DX personnel will develop the hardware and software models based on PDL data. Payloads or experiments which fall within the standard volume envelope may not be required to produce a balloon model.

6.6 PORTABLE TRAINING MATERIALS

PDs will be responsible for developing portable training materials to support training for their payloads or experiments. Initial requirements for portable training materials are provided in Section 4.1 (Training Equipment) of this document. More detailed requirements for these materials will be developed during the TST process. Depending upon the payload or experiment and the outcome of the TST process, portable training materials can be either the sole means of supporting payload training for the crew or serve as supplementary courseware for both crew and GSP training. The following subsections provide justification for the use of various portable training mediums for payloads or experiments.

Portable training materials should be developed and verified by the PD prior to the PTDR. Six weeks prior to training, the SE and crew representative will be responsible for conducting a PTDR before the portable training materials can be used for payload training of the crew. If portable training materials will be used for OBT, a PTDR must also be performed and the materials certified. However, the timeframe and process is different.

6.6.1 Computer-Based Training

PDs will develop CBT modules to support payload training according to requirements and guidelines defined in the MTMP, Volume 1 (Appendix F). CBT lessons can be utilized instead of a stand-alone trainer for simple payloads or experiments without operational hazard controls and to supplement the training for complex, long-term payloads or experiments. CBT lessons will be particularly advantageous to payload training for the following reasons:

A. The same module can be used for Payload or Experiment Science/Operations, Proficiency, and Refresher training for the crew both on the ground and on board as long as it adheres to the OBT Media Requirements.

B. Transportability, ease in reproduction, and ease in distribution supports training large numbers of personnel in multiple locations and provides training in critical periods where crew travel constraints must be adhered to.

C. One publication can support training in multiple languages.

D. One module can support multiple student levels and training on a large variety of science, engineering, and operational aspects of a facility/payload/experiment.

E. CBTs can provide a sole source of reference and training material for crew, GSP, PDs, and Payload Instructors to promote commonality in terminology and general knowledge.

6.6.2 Training Videos

PDs should consider the use of payload or experiment training videos to support crew and GSP training during all phases of payload training. Similar to CBT modules, training videos are a transportable, easily reproduced, and easily distributed training medium. Video footage provides an efficient and cost-effective means of documenting the correct implementation of operational procedures for a specific facility, payload, or experiment. Payload training videos will be particularly advantageous in assisting Payload Instructors in performing proficiency training on other PDs payloads or experiments. Payload training videos shall adhere to the overall Program standards for training videos defined in the MTMP, Volume 1.

6.6.3 Training Manuals

PDs should consider developing training manuals to support the training of crew, GSP, and Payload Instructors on payload or experiment equipment and operations. All

training manuals should be developed in accordance with Program standards defined in the MTMP, Volume 1. In addition to the essential components of a training manual determined by these standards, manuals for payload training may contain photographs, drawings, schematics, procedures, descriptions, and publications which familiarize the trainee with payload/experiment equipment, payload/experiment operations and constraints, ISS system interfaces, scientific background, and scientific applications. Training manuals are cost effective, easily updated, and transportable, and they require no resources for usage.

6.7 UTILIZATION DEVELOPMENT CAPABILITY

The UDC, located at JSC, will provide POIC cadre and science teams training in payload operations for the ISS. This capability will also serve to assist in the development and verification of payload operations procedures and flight displays.

6.7.1 Payload Training Capabilities in the UDC

The UDC will have a command and telemetry interface with the Enhanced HOSC System (EHS) to provide on-console cadre and GSP training during training exercises. The UDC host environment will provide for simulation of ISS systems and subsystems which support payload operations. The host environment will also allow for the integration of PTU models to simulate payload health and status data. A Remote Area for Payload Support (RAPS) will be resident at the UDC. The RAPS will allow payload training personnel and/or POIC cadre to remotely support crew training sessions at the SSTF/PTC.

6.7.2 Payload Training Types and Objectives in the UDC

The UDC will support GSP Generic Operations training, GSP Payload-Specific training, and GSP Payload-Only Simulations. The UDC will be used by POIC cadre to receive individual training on ISS subsystems and payloads or experiments. UDC IOSs will support these training activities. This training will include, but not be limited to, command management, data distribution, and Short-Term Plan development. Science teams will also be welcome to use the UDC to familiarize themselves with the ISS systems which will interface to their payloads or experiments.

The UDC will be capable of supplying payload and subsystem data during GSP Payload-Only Simulations. The UDC will possess data and voice interfaces with the POIC. From the POIC, these links will be distributed to the U.S. Operations Center (USOC), TSCs, and other remote sites in a flight-like manner. The payload simulation team, with assistance from SEs, will be responsible for conducting and tracking GSP Payload-Only Simulations.

7, PAYLOAD INSTRUCTOR TRAINING AND CERTIFICATION

A Payload Instructor will be any individual responsible for training crew and/or GSP on payload or experiment operations. Training and certification of Payload Instructors will be necessary to ensure that accurate and efficient training will be provided to all payload trainees. Instructors, in general, should possess basic competencies as defined in Section 6.0 of the SPIP, Volume 7 (i.e., instructional, technical subject matter, training facility, and language competencies). Competency on technical subject matter for Payload Instructors should be required in the following areas:

A. Facility science objectives

B. Facility hardware systems

C. Facility software systems

D. Facility/ISS/ground interfaces

E. Payload/experiment objectives

F. Payload/experiment science applications including live biological specimen handling

G. Stowage equipment and stowage plan (including trash)

H. LSE/SSE

I. Safety issues/concerns

J. Payload/experiment operational constraints

K. Payload/experiment nominal operations

L. Payload/experiment routine and corrective maintenance operations

M. Payload/experiment alternate/malfunction operations

N. Payload/experiment transport operations

O. Payload/experiment transfer operations

P. Inventory Management System interfaces

Although a single Payload Instructor may not possess expertise in each of the topics defined above, the defined team of Payload Instructors performing training for a particular payload or experiment should possess competency across all of these areas.

Regardless of where training will occur, each Payload Instructor must successfully accomplish a PTDR on each lesson they are instructing in order to be certified. Each lesson, and the Payload Instructor for that lesson, will remain certified until either the lesson changes or the Payload Instructor changes. The TST will determine if a delta PTDR is needed, based on the amount of change. See Appendix E of this document for the complete PTDR process.

For a defined payload complement, the PTI will be responsible for gathering data which identifies Payload Instructors for each lesson and certification data for each instructor on that lesson.

7.1 PAYLOAD INSTRUCTOR CERTIFICATION REQUIREMENTS

This section describes the certification requirements for any Payload Instructor intending to teach a specific payload/experiment or facility lesson. These certification requirements must be met regardless of where training is scheduled to take place.

7.1.1 Eligibility Requirements

To be eligible as a Payload Instructor, a person must:

A. Have a bachelor's degree from an accredited institution of higher learning or equivalent experience. (NOTE: A bachelor's degree is desired, but the PD may opt to waive this requirement for their instructor.)

B. Be able to read, speak, write, and understand the English language.

C. Be assigned to the payload training organization at MSFC/JSC or be designated as an Instructor by the PD for their specific payload/experiment/facility.

D. Be able to understand and utilize training documentation identified in the following sections as well as throughout this document.

E. Be able to conduct all scheduled lessons unless a certified backup instructor is available.

7.1.2 Knowledge Requirements

General knowledge required includes not only being a SME. The Payload Instructor must be aware of applicable training documentation and be able to understand and capably implement payload training processes defined throughout the payload training documentation. Knowledge requirements for certification are:

A. The Payload Instructor must be knowledgeable on the subject matter (assigned payload/experiment/facility).

B. The Payload Instructor must be capable of developing an approved lesson plan for their subject matter per the Payload Lesson Development Plan document.

C. The Payload Instructor must have a general understanding of the following:

(1) The training processes as defined in the NASA PTIP.

(2) The major stages of the Training Development Process as documented in the PUDG.

(3) The capabilities of the facilities where training will occur (e.g., SSTF/PTC SSMTF, etc.).

(4) The training requirements for the assigned payload as documented in the Payload Training Data Set, the MITP, and the Crew Training Catalog.

7.1.3 Skills Requirements

General skills required for Payload Instructor certification include:

A. The Payload Instructor must possess good communication and delivery skills in the presentation of the subject matter.

B. The Payload Instructor must comprehend and effectively use the appropriate instructional method.

C. The Payload Instructor must comprehend and select the appropriate instructional media to optimize training.

7.1.4 Experience

Experience required will be met by the following:

A. A Payload Instructor from the payload training organization at MSFC/JSC must have successfully completed the Instructor Training Course (ITC).

B. A Payload Instructor assigned by the PD must have reviewed the Payload Lesson Development Plan document and followed its guidelines when preparing lesson plans.

C. A Payload Instructor must demonstrate the above required knowledge and skills through the successful execution of a PTDR (including any deltas required to maintain certification).

7.1.5 Post-Certification Requirements

Once certified on a specific lesson, the Payload Instructor must perform all responsibilities associated with being a Payload Instructor until another Payload Instructor is certified. When a PD decides another Payload Instructor needs to become certified on their lesson, the PD must:

A. Provide the Payload Instructor with the knowledge and skills to develop and deliver the lessons.

B. Support the instructor certification by attending the PTDR as a subject matter expert.

7.2 PAYLOAD LESSON TRANSITION PROCESS

This lesson transition process defines what needs to occur in order for a certified lesson to be handed over from either the PD's Payload Instructor or SE to a JSC Payload Instructor.

7.2.1 Groundrules

This process will be applied to each individual lesson with a Payload Training Flow. Each Payload Training Lesson Flow identifies the lesson that will be handed over to JSC/DT and also identifies the organization and/or personnel responsible for lessons that will not be handed over.

If lesson handover is planned to occur within 90 days of the PTDR date, the handover instructor will be certified during the PTDR timeframe, with approval by the SE and/or PD and the DT4 branch chief or DT42 group lead.

If lesson handover occurs later than PTDR + 90 days, the JSC Payload Instructor will be certified by the process outlined below:

A. Observe lesson instruction by certified instructor. Also, study lesson plan and courseware materials and resolve technical/instructional issues with the lesson developer.

B. Instruct an additional PTDR session. After successful completion of the PTDR session, Go-for-Cert approval is required from the SE and/or PD and a DT Curriculum Developer.

C. Instruct a formal certification session. Finally, certification approval is required from the DT4 branch chief or DT42 group lead.

7.2.2 Requirements

During the training development process, several different groups of people will be responsible for activities that must take place in order to have an orderly and efficient handover of payload training responsibilities. The following paragraphs define those responsibilities.

Payload Training Team (includes PD, Instructor, SE, JSC Payload Instructor)

A. Develop the Payload Training Plan package and distribute the package among the team members for review and familiarization prior to submission. The package could include the Payload Training Flow, Simulator/Trainer Level A Functional Requirements, Level 5 Schedule, Simulator/Trainer development specification, etc.

B. Coordinate the distribution of technical reference materials listed below among team members to support SME building with a target of completion not less than 6 weeks prior to PTDR:

(1) PL CDR package

(2) OPS Products (PL displays, procedures, etc.)

(3) PL Simulator/Trainer operation/maintenance instructions

(4) Other materials as determined by the team

C. Coordinate the development of lesson plans and courseware materials (handouts, slides, etc.) and distribute among team members for review and familiarization with the following schedule guidelines:

(1) Handover occurs prior to PTDR + 90 days – The handover instructor should work closely with the lesson developer throughout the development process to ensure the capability to certify at PTDR.

(2) Handover occurs later than PTDR + 90 days – Lesson plans and courseware materials available not less than 2 weeks prior to PTDR.

Sim Engineer and/or PD

A. Support resolution of technical/instructional issues with the handover instructor as identified during the transition process.

B. Instruct the PTDR and first crew presentation of the lesson.

C. For a hands-on lesson, instruct one session with the handover instructor as the primary student.

D. For certification outside of the PTDR, participate in the Go-for-Cert session and provide go/no go evaluation.

Handover Payload Instructor

A. Observe the PTDR and first crew presentation for SME building and for familiarization with the lesson flow.

B. Observe the PSIIC, phase 1 and PSAT, if applicable.

C. For a hands-on lesson, participate in one session as the primary student.

D. Resolve technical/instructional issues with the Sim Engineer/PD as required.

E. Instruct at least one practice teaching session to prepare for the Go-for-Cert session (Internal to DT).

F. Instruct a Go-for-Cert session (Internal to DT).

G. Instruct a Certification session (Internal to DT).

7.3 PAYLOAD INSTRUCTOR WAIVERS

Experience has shown the possibility may occur where the certified Payload Instructor for a particular lesson is not available when training is scheduled due to last minute changes in training schedules. It is also possible a different instructor may be a SME and have taught a similar class during a space program other than ISS and is available to teach.

In these cases, it is possible a waiver for another instructor to teach the lesson without conducting a PTDR for certification could be granted. Waivers will be granted on a case-by-case basis. The following requirements must be met to provide a Payload Instructor a waiver to teach a specific lesson without first conducting a PTDR:

A. The course materials must have already passed a PTDR.

B. The Proposed instructor is a Subject Matter Expert on this subject (with PD approval).

C. The instructor has successfully instructed a crew before in the same method and medium.

D. A review of the Crew Evaluations for the instructor's previous courses shows no negative remarks about the instructor.

Upon presentation of the above evidence and with the concurrence by the PD, the original instructor, the sim engineer, and a Crew Office Representative, the proposed instructor will be certified to train. The SE will notify the PTI of all Instructor Waivers for maintaining the certified instructor list.

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SECTION 8, SIMULATION PLANNING AND VERIFICATION

During the sim planning and verification process, hours and objectives for GSP Payload-Only Simulations, Integrated Payload-Only Simulations, and payload participation in JMST are defined. This information is provided to appropriate groups for detailed planning and verification of simulation products. The following subsections define the structure and activities of groups that support these efforts.

8.1 PAYLOAD-ONLY SIMULATION WORKING GROUP

Payload-Only Simulations can be conducted for just GSP (GSP Payload-Only Simulations) and for crew and GSP combined (Integrated Payload-Only Simulations). The POSWG begins the process of detailed simulation planning and verification. This group is chaired by the Payload Simulation Director and includes the POD, PTI, Increment Simulation Supervisor, Payload Simulation Coordinator, SEs, POIC representatives, PD representatives, JSC Payload Instructors, crew representative, and the Station Training Lead (STL). The POSWG will use the Payload-Only Simulation hours and objectives and the standard guidelines as defined in the Payload Simulation Guidelines Document to plan Payload-Only Simulations. This group will meet intermittently during the I-14 to I-6 timeframe. The objectives of this group will be to:

A. Approve generic objectives developed for Payload-Only Simulations.

B. Define and approve detailed objectives for Payload-Only Simulations.

C. Define and coordinate detailed requirements and resources for conducting Payload-Only Simulations.

D. Finalize schedules for Payload-Only Simulations.

E. Identify data products for Payload-Only Simulations.

The plans and products generated by the POSWG will then be used by the payload simulation team to develop simulation scripts and perform pre-simulation verifications of facilities and products. The payload simulation team, led by the Payload Simulation Director, includes the Increment Simulation Supervisor, Payload Simulation Coordinators, and SEs. JSC Payload Instructors and the STL also work as part of the payload simulation team when required. Pre-simulation checkout activities will occur between Simulation minus (sim-) 2 months and simulation start to verify facility configurations, scripted events, and the flow of data, voice, and video. At the completion of these verifications, the payload simulation team and simulation products are ready to conduct the Payload-Only Simulations.

8.2 JOINT MULTI-SEGMENT TRAINING WORKING GROUP

One function of the JMSTWG is to plan payload participation in JMST. This group is co-chaired by the STL and the Payload Simulation Director. Other participants may be the PTI, Increment Simulation Supervisor, Payload Simulation Coordinator, SEs, JSC Payload Instructors, crew representative, POIC representatives, and PD representatives. The JMSTWG will define the hours and objectives for payload participation in JMST. This group will meet intermittently during the I-6 through crew launch timeframe. The objectives of this group will be to:

A. Define and approve detailed objectives for payload participation in JMST.

B. Coordinate requirements and resources for conducting JMST involving payloads and experiments.

C. Finalize schedules for payload participation in JMST.

D. Develop script inputs and payload data products for JMST involving payloads and experiments.

E. Determine SSTF/PTC ISPR configuration.

The plans and products generated by the JMSTWG will be used by the simulation teams at various locations to complete simulation schedules, scripts and data products for JMST. Once integrated, these plans and products are used to perform pre-simulation checkout activities. The STL is responsible for these verification activities with support from the payload simulation team for the payload aspects of the checkout. At the completion of these verifications, the payload simulation and payload products are ready to support payload participation in JMST.

APPENDIX A

ABBREVIATIONS AND ACRONYMS

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A, ABBREVIATIONS AND ACRONYMS

A	Ampere
ac	Alternating Current
A/G	Air to Ground
AOS	Acquisition of Signal
APM	Attached Pressurized Module
BDC	Baseline Data Collection
CAM	Crew Activity Manager or Centrifuge Accommodation Module
CBT	Computer-Based Trainer (Training)
C&DH	Command and Data Handling
COF	Columbus Orbital Facility
CoFR	Certification of Flight Readiness
COTS	Commercial off-the-Shelf
COU	Concept of Operations and Utilization
CR	Change Request
CRT	Cathode Ray Tube
CSIOP	Crew Station Input/Output Processor
C&T	Communications and Tracking
DGCS	Display and Graphics Commonality Standards
DV	SSTF Project Office Operations (NASA)
E	Envelope Fidelity
E-PIM	EXPRESS Payload Integration Manager
ECLSS	Environmental Control and Life Support System
EHS	Enhanced HOSC System
EIA	EXPRESS Integration Agreement
EHS	Enhanced HOSC System
ENV	Environment
EPS	Electrical Power System
EVA	Extravehicular Activity
EXPRESS	EXpedite the PRocessing of Experiments to Space Station
F	Functional Fidelity
FCSL	Flight Crew Support Laboratory
FEU	Flight Equivalent Unit
FUR	Facility Utilization Request

g	Gravity
GN&C	Guidance, Navigation, and Control
GSP	Ground Support Personnel
GTI	Ground Training Integrator
H/W	Hardware
I-	Increment minus
I/O	Input/Output
ICD	Interface Control Document
IDAGS	Integrated Display and Graphical Standards
IDRD	Increment Definition and Requirements Document
IMS	Inventory Management System
IOS	Instructor/Operator Station
IP	International Partner
ISS	International Space Station
ISPR	International Standard Payload Rack
ITC	Instructor Training Course
ITCB	International Training Control Board
ITI	Increment Training Integrator
ITRR	Increment Training Readiness Review
iURC	interim User Requirements Collection
JEM	Japanese Experiment Module
JIT	Just-In-Time
JMST	Joint Multi-Segment Training
JMSTWG	Joint Multi-Segment Training Working Group
JSC	Johnson Space Center
KSC	Kennedy Space Center
kW	Kilowatt
L-	Launch minus
LAN	Local Area Network
LNS	Lab Nitrogen System
LOS	Loss of Signal
LSE	Laboratory Support Equipment
MATP	Multilateral Advanced Training Plan
MCC-H	Mission Control Center - Houston

MCC-M	Mission Control Center - Moscow
MIL	Military
MITP	Multilateral Increment Training Plan
MOA	Memorandum of Agreement
MOD	Mission Operations Directorate
MOL	Mission Operations Laboratory
MRMDF	Multi-Use Remote Manipulator Development Facility
MSFC	Marshall Space Flight Center
MTMP	Multilateral Training Management Plan
N_2	Nitrogen
NASA	National Aeronautics and Space Administration
NBL	Neutral Buoyancy Laboratory
NPOCB	NASA Payload Operations Control Board
NTIP	NASA Training Implementation Plan
NTSC	National Television Standards Committee
OBCS	On-Board Computer System
OBT	On-Board Training
OBTWG	On-Board Training Working Group
OCBT	On-board Computer-Based Trainer
ODF	Operations Data File
ODFCB	Operations Data File Control Board
OOM	On-Orbit Maintenance
OOS	On-Orbit Summary
OSTP	On-board Short Term Plan
P	Physical Fidelity
PAYCOM	Payload Communications Manager
PCB	Payload Control Board
PCRC	Payload Complement Requirements Checklist
PCRT	Payload Complement Requirements Test
PCTP	Payload Complement Training Plan
PCS	Portable Computer System
PD	Payload Developer
PDC	Payload Development Center
PDL	Payload Data Library Payload Development Laboratory
PDR/CDR	Payload Design Review/Critical Design Review
PDRP	Payload Display Review Panel
PEHG	Payload Ethernet Hub Gateway

PGSPT	Payload Ground Support Personnel Training
PIA	Payload Integration Agreement
PIM	Payload Integration Manager
PL	Payload
PLCR	Payload Lesson Change Request
PLSS	Payload Support System
POCB	Payload Operations Control Board
POD	Payload Operations Director
PODF	Payload Operations Data File
POIC	Payload Operations Integration Center
POIF	Payload Operations Integration Function
POSWG	Payload-Only Simulation Working Group
PRU	Payload Resource Utilization
PSAT	Payload Simulator Acceptance Test
PSE	Payload Simulator Environment
PSIIC	Payload Simulator Inventory and Interface Checkout
PSimNet	Payload Simulator Network
PSRD	Payload Simulator Requirements Document
PSTP	Payload Simulator Test Procedure
PTC	Payload Training Capability
PTDR	Payload Training Dry Run
PTI	Payload Training Integrator
PTIP	Payload Training Implementation Plan
PTLP	Payload Training Lesson Plan
PTO	Payload Training Organization
PTP	Payload Training Panel
PTS	Payload Training Simulators
PTU	Payload Training Unit
PUDG	Payload User Development Guide
QA	Quality Assurance
RAPS	Remote Area for Payload Support
RBA	Rack Buildup Area
RFT	Ready For Training
RMS	Remote Manipulator System
RPWG	Research Program Working Group
S/G	Space-to-Ground
S/W	Software
SCE	Signal Conversion Equipment

ScS-E	Suitcase Simulator for EXPRESS
ScS-P	Suitcase Simulator for Pallet
SE	Simulation Engineer
SFD	Space Flight Division
sim	Simulation
sim-	Simulation minus
SKA	Skill, Knowledge, Attitudes
SLAB	Secondary Lab
SME	Subject Matter Expert
SPIP	Station Program Implementation Plan
SPTC	Stand-Alone Payload Training Capability
SRMS	Shuttle Remote Manipulator System
SSC	Station Support Computer
SSCC	Space Station Control Center
SSE	Station Support Equipment
SSMTF	Space Station Mockup Training Facility
SSTF	Space Station Training Facility
STEP	Suitcase Test Environment for Payloads
STFx	Simulator Test Fixture
STD	Standard
STL	Station Training Lead
STP	Short-Term Plan
SVMF	Space Vehicle Mockup Facility
SWG	Simulation Working Group
T	Total Fidelity
TAMS	Training Administration and Management System
TBR	To Be Resolved
TCS	Thermal Control System
TDR	Training Development Review
TIM	Technical Interchange Meeting
TIP	Training Implementation Plan
TQT	Trainer Qualification Test
TRR	Training Readiness Review
TRRB	Test Readiness Review Board
TSC	Telescience Support Center
TST	Training Strategy Team
U.S. Lab	United States Laboratory
U.S.	United States
UDC	Utilization Development Capability

USOC	United States Operations Center
V	Volt or Visual Fidelity
Vac	Volts, Alternating Current
Vdc	Volts, Direct Current
Vol.	Volume
VS	Vacuum System
VSD	Video Switching and Distribution
WWW	World Wide Web

APPENDIX B

GLOSSARY OF TERMS

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B, GLOSSARY OF TERMS

Advanced Training - Phase of training which provides a more in-depth understanding of systems, payloads/payload support systems, and operations of the ISS and prepares Space Station crewmembers for assignment to a flight.

Baseline Data Collection - Medical data collected during crew payload training on individual crewmembers 6 months prior to increment launch and for 6 months after the crewmember's return. This data is used to compare/contrast with medical data that is collected on orbit.

Basic Training - Phase of training which provides a foundation of space science and operations knowledge, skills, and attitudes. This training is a prerequisite for Advanced training and must ensure a minimum acceptable level of knowledge and skills of incoming ISS crewmembers.

Crew Activity Manager - An individual whose responsibilities include developing, maintaining, and implementing the detailed Crew Training Plan, which covers the entire training flow for an assigned crew set (regardless of location). This individual also develops the weekly crew activity schedules for training in U.S. facilities.

Computer-Based Training - Interactive training presented on a computer platform.

Currency Requirement - The maximum time span between training sessions or between training and operations to maintain the agreed to level of proficiency.

EXPRESS Rack - An ISPR with additional hardware for accommodating small sub-rack payloads or experiments, such as those in Shuttle middeck lockers and standard interface rack drawers.

Experiment - An activity performed using a payload, with or without human assistance.

Facility-Class Payload - A payload with hardware subsystems for supporting a variety of experiments. Experiment-specific hardware is usually delivered to the ISS separately. Facility hardware usually will occupy more than one rack location and will remain on board the ISS for many increments, if not permanently.

Ground Support Personnel - Control centers and science team personnel who support realtime operation of the ISS. For payloads, GSP refers to the POIC cadre and science teams in the USOC, TSC, or remote sites, all supporting realtime payload operations.

Ground Training Integrator - Personnel responsible for management and implementation of GSP training.

Increment - A variable block of time used by the ISS Program for grouping activities to be performed on board the ISS. The length of an increment will be set to the timespan for which a given crew set is on board the ISS, and typically will vary between 2 and 4 months, once payload operations begin.

Increment-Specific Training - Training phase which includes mission-specific activities, proficiency training on skills and systems operations, and team training.

International Space Station - The Space Station to be composed of major elements from many nations, including the U.S., Russia, Europe, Japan, Canada, and Italy. The ISS is a place for humans to perform scientific and commercial research to improve the lives of others on Earth and in space.

International Space Station Program - The international organization responsible for ISS design, construction, operation, and utilization. The latter consists of payload integration and payload operations.

Joint Multi-Segment Training - Training involving the crew and mission controllers combined. During JMST, a training facility is connected to two or more control centers simultaneously.

Moding - The operational control of a simulator (e.g., run, pause, freeze, stop, terminate, etc.)

On-Board Training - Training conducted by the crew on orbit. May include Refresher, Proficiency, or JIT training.

Payload - The hardware (including structure), replacement parts, software, support equipment, and/or specimens provided by the PD/Partner to the ISS Program for transport to and from the ISS Program, and for installation and operation on board. The payload can be any size or shape, ranging from one that could fit in a stowage drawer or middeck locker location, to one that occupies several rack locations (see facility-class payload) or an external pallet. The ISS Program will treat the payload as a single entity except in those instances where parts of the payload must be handled separately by ISS Program personnel.

Payload Complement Training - Training that is conducted per increment to provide instruction on all equipment, products, and procedures required to operate a defined payload complement.

Payload Developers - Personnel who develop payload, experiment, and facility hardware/software. This term is commonly used to represent all personnel who

support payload, experiment, and facility operations from the ground, including PIs and any other support personnel (synonymous with science team).

Payload Development Center - A development site for ISS payload flight hardware, software, and operational products to support a specific scientific discipline.

Payload Ground Support Personnel Training Coordinator - Personnel responsible for coordination and administration of GSP training.

Payload Training Integrator - Personnel responsible for the overall definition, development, administration, integration/verification, and execution of payload training for the Space Station crew and GSP within a payload complement.

Payload Training Unit - A hardware and/or software representation of an ISS facility, payload, or experiment used for training (synonymous with simulator).

Payload Transfer Training - Training that involves crew activities that are performed to transfer payloads or experiments to/from the Space Station from/to the transport vehicle and install the hardware.

Payload Transport Training - Training that involves crew activities that are performed while the payload or experiment is on board the transport vehicle.

POIC Cadre - A group of trained personnel assigned to functional discipline teams at the POIC who perform pre-increment planning, preparation, and realtime monitoring and control of payloads and payload-related systems in support of integrated payload operations.

Pressurized Payload - A payload placed on board the ISS inside a pressurized element (e.g., U.S. Lab, Attached Pressurized Module (APM), Japanese Experiment Module (JEM)).

Proficiency Training - Training that occurs after the initial set of training. In some cases, it may be repetitious of the initial individual operations procedures training or it may focus on unique skills that require periodic training.

Refresher Training - Training conducted on an as-needed basis. It is not required at specific intervals, but may be taken just before Increment-Specific training sessions or on board if it has been a significant length of time since training was last taken.

Science Teams - Those personnel who support payload, experiment, and facility operations from the ground (synonymous with Payload Developers).

Shuttle Crew - Astronauts who launch on a Shuttle or Soyuz, perform assembly or utilization tasks, and return on the same Shuttle/Soyuz flight. These astronauts do not stay on board after the Shuttle/Soyuz leaves.

Station Crew - Individuals who operate and maintain the Station systems and payloads/experiments on orbit in support of Space Station increment operations.

Station Training Lead - Individual responsible for the planning and execution of all team training at JSC.

Training Facility - The structure housing a training device, classrooms, study areas, training support areas, shop areas, storage, etc.

APPENDIX C

NASA PAYLOAD TRAINING STRATEGY TEAM GUIDELINES

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C, NASA PAYLOAD TRAINING STRATEGY TEAM GUIDELINES

TIM #1-1 TST Introduction and Payload Training Overview
(Conducted per payload or experiment)

Objective: *To introduce the PD to the TST Process, payload training concepts, payload training documentation, and payload training processes. To start the PD working on their curriculum and in PDL.*

Attendees: Simulation Engineer (Chair), PD Trng Reps (including PD team members with facility, payload, and experiment operations knowledge), JSC Payload Instructor, Crew Rep

Agenda:

• TST Roles, Responsibilities, Objectives, and Products	SE
• Payload Training Paradigm	
• Overview of Payload Training Documentation	
• Overview of Payload Training Curriculum, Types, & Phases	
• Overview of PDL & Payload Training Data Set	
• Overview of Generic Payload Training Template	
• Review of Program-defined PD Training Requirements & Responsibilities to support training	
• Payload/facility/experiment flight schedule (for upcoming flights)	PD
• Introduce other important players in the training process	SE
• Introduce pertinent web sites to PDs	SE
• Discuss purpose and dates of future TIMs	All
• Schedule TIM #1-2	SE
• Assign actions and due dates	SE

Post TIM Products & Activities:

Review generic curriculum & determine applicability to the payload/experiment	PD
Submit request for PDL account, receive account, review training screens	PD
Provide Payload Training Documentation that PD needs	SE
Work actions	Actionees
Distribute minutes of this TIM/Forward programmatic issues	SE

TIM #1-2 **Crew Training Curriculum Development/PTU Planning**
(Conducted per payload or experiment)

Objectives: *To define the payload's/experiment's crew training curriculum and provide an introduction to the requirements for development of training equipment.*

Attendees: Simulation Engineer (Chair), JSC Payload Instructor, PD Trng Reps (including PD team members with facility, payload, or experiment operations knowledge), SSTF/PTC Rep, Crew Rep

Agenda:		
	• Hardware & Software Description and Operations Overview (for each piece of H/W and experiment)	PD
	• Discuss and Assess Crew Training Curriculum and Hours using Training Assessment Form	All
	• Discuss and Assess OBT Possibilities	All
	• Define All Crew Training Equipment (including PDC, if applicable)	PD
	• Discuss PTC, SSMTF, NBL, and Robotics Capabilities/ Interfaces, if necessary	SE
	• Discuss PTU Classes/Component Fidelity	
	• Discuss Generic PSRD, Vol. 1 and Trainer Development Specification	
	• Schedule future Crew Training Curriculum/Hours TIM, if required	All
	• Schedule TIM #1-3, if required	SE
	• Assign actions and due dates	SE

Post TIM Activities & Products:

Update payload/experiment-specific curriculum	PD
Initial training input into the PDL	PD
Prepare PTU plans for next TIM	PD/SE
Prepare preliminary PLCR	JSC PL Inst
Prepare OBT Description Form (if applicable)	PD
Update Training Assessment Form	SE
Work actions	Actionees
Distribute minutes of this TIM/Forward programmatic issues	SE

TIM #1-3 **Training Tools Development**
(Conducted per payload or experiment)

Objective: *To define the training equipment which will be developed to support training for the payload or experiment and identify training instructors.*

Attendees: Simulation Engineer (Chair), JSC Payload Instructor, PD Trng Reps (including PD team members with training equipment knowledge), SSTF/PTC Rep, Crew Rep

Agenda:

• PTU Proposal (includes components, fidelities, locations, quantities, and training objectives)	
- PDC training equipment proposal	PD
- JSC training equipment proposal	PD
• Other Crew Training Tools	
- CBT Development	PD
- Training videos, training manuals, other training mediums	PD
- OBT Development	PD
• Payload Instructor Training and Certification Requirements (who, how, when)	SE
• Present Draft PLCR to TST for Review	JSC PL Inst
• Schedule future Simulator and Training Tool TIM, if required	All
• Schedule TIM #1-4, if required	SE
• Assign actions and due dates	SE

Post TIM Activities & Products:

Update PTU/Training Equipment Proposals	PD
Update PDL input (including PTU & other training tools)	PD
Prepare Training Equipment Development & Delivery Schedules	PD/SE
Develop Payload Instructor Training Plan/Schedule	PD/SE
Prepare Final Draft of PLCR	JSC PL Inst
Finalize Training Assessment Form	SE
Work actions	Actionees
Distribute minutes of this TIM/Forward programmatic issues	SE

TIM #1-4 **Training Readiness Planning**
(Conducted per payload or experiment)

Objective: *To ensure readiness of materials, equipment, personnel, and sites to support crew training.*

Attendees: Simulation Engineer (Chair), PD Trng Rep, JSC Payload Instructor, Crew Rep

Agenda:

• PDC Training Readiness	
- Lesson Plan and Courseware Development Status/Schedule	SE/PD
- Training Equipment Development and Delivery Schedule	SE/PD
- Payload Training Dry Run Schedule	SE/PD
• JSC Training Readiness	
- Lesson Plan and Courseware Development Status/Schedule	SE/PD
- PTU Development and Delivery Schedules	PD/SE
- PTU Installation & Verification Schedules	SE/PD
- Payload Training Dry Run Schedule	SE/PD
- Post Training Responsibilities	SE/PD
• Payload Instructor Training and Certification Status and Schedules for the PDC and JSC Training Facilities	PD/SE
• Present PLCR to TST for review, concurrence, and signature	JSC PL Inst
• Define TST #1 Agenda/Schedule	All
• Assign actions and due dates	SE

Post TIM Activities & Products:

Finalize Training Development/Verification/Certification Issues	PD/SE
Close actions prior to TST	Actionees
Form consensus on the training plan or forward issues and concerns to the PTI at TST #1	SE/PD
Distribute minutes of this TIM/Forward programmatic issues	SE

TST #1 **Formal Presentation of TST Phase 1 Results**
(Conducted per payload or experiment)

Objective: *To provide to the PTI the Training Strategy Team Plan of the crew's payload or experiment training requirements and how the training will be accomplished.*

Attendees: Simulation Engineer (Chair), Crew Rep, PD Training Rep, PTI

Agenda:		
	• Payload or experiment H/W, S/W and Operations overview	PD
	• Crew Training Curriculum/Hours Presentation	SE
	• PDC Training Readiness Status/Schedules	
	- Lesson Plans	SE
	- Training Equipment	
	- Payload Training Dry Run	
	- Payload Instructor Training and Certification	
	• JSC Training Readiness Status/Schedules	SE
	- Lesson Plans	
	- PTU Development, Delivery, Installation, Verification	
	- Payload Training Dry Run	
	- Payload Instructor Training and Certification	
	• On-Board Training & Other Training Tools Presentation	SE
	- Present OBT Description Form	PD
	- Present PLCR for PTI Signature	JSC PL Inst
	• Other Issues	SE
	• Actions	

Post TST Activities & Products:

Forward programmatic issues	PTI
Work actions	Actionees
Distribute minutes of this TST	SE

TIM #2-1 **Payload Complement Crew Training**
(Conducted per Payload Complement)

Objective: *To allow the PTI to integrate individual and payload complement crew training requirements for the Payload Complement.*

Attendees: Payload Training Integrator (Chair), Sim Engineers, Payload Instructors, Crew Rep, Station Training Lead, PD Training Reps. (optional), Increment Simulation Supervisor

Agenda:		
	• Payload Complement Training Plan Status - Compiled Results from Individual Payload TSTs - Estimates on Standard EXPRESS Payloads not yet manifested	PTI
	• Payload Complement Training - Objectives - Estimated Hours/Schedule	PTI
	• Payload Instructor Training & Certification	PTI
	• Issues to Resolve	All
	• Assign actions and due dates	PTI

Post TIM Activities & Products:

Work actions	Actionees
Distribute minutes of this TIM	PTI

POSWG-1 Planning for Crew Participation in Simulations
(Conducted per Payload Complement)

Objective: *To allow the Payload Simulation Director to define high level requirements for simulations requiring crew participation for the payload complement.*

Attendees: Payload Simulation Director (Chair), Payload Training Integrator, Sim Engineers, Payload Instructors, STL, PD Trng. Reps, Increment Simulation Supervisor, Payload Simulation Coordinator, Payload GSP Training Coordinators, MSFC POIF Reps, Crew Rep, Ground Training Integrator

Agenda:		
	• Integrated Payload-Only Simulations - Objectives of each simulation - Estimated Hours & Timeframes for each simulation	PL Sim Dir
	• Payload Participation in Joint Multi-Segment Training - Objectives of each simulation - Types of JMST for payloads to participate in - Estimated Hours & Timeframes for each simulation	PL Sim Dir
	• Issues to Resolve	All
	• Assign actions due prior to TST #2	PL Sim Dir

Post POSWG-1 Activities & Products:

Work actions prior to TST #2	Actionees
Distribute minutes of this TIM	PL Sim Dir
Assist PTI in TST Preparation	PL Sim Dir

Status Review **Crew Payload Complement Status to PL Training Panel (PTP)**
(Conducted per Payload Complement)

Objective: *To provide a status of the crew training requirements for the Payload Complement to the PTP.*

Attendees: Payload Training Integrator (Chair), Payload Training Panel

Agenda:

- Payload Complement Training Plan Status — PTI
  - Individual Payload Hours/Objectives (including Standard EXPRESS Payload estimates)
  - Payload Complement Hours/Objectives
  - Integrated Payload-Only Simulations Hours/Objectives
  - Payload Participation in Joint Multi-Segment Training Hours/Objectives
- Draft Crew Payload Training Schedule
- Crew Payload Training Issues/Concerns
- Payload Instructor Training & Certification Status
- Actions

Post Status Review Activities & Products:

Finalize crew portion of MITP	PTI
Work actions	Actionees

TIM #2-2 **Cadre Training**
(Conducted per payload or experiment)

Objective: *To define the plan for training the cadre on the payload's/experiment's operations.*

Attendees: Ground Training Integrator (Chair), Payload Ground Support Personnel Training Coordinator, Simulation Engineer, Payload Simulation Director, Increment Simulation Supervisor, Payload Simulation Coordinator, MSFC POIF Reps

Agenda:		
	• Capabilities Overview: - PTC - RAPS	SE
	• Cadre Training Plan Discussion: - Payload Overview Training	GTI
	• Assign actions and due dates	GTI

Post TIM Activities & Products:

Finalize Cadre Training Plan for Payload/Experiment	GTI
Work actions	Actionees
Distribute minutes of this TIM	GTI

TIM #2-3 **Science Team Training**
(Conducted per payload or experiment)

Objective: *To define the plan for training the science team.*

Attendees: Ground Training Integrator (GTI), Payload Ground Support Personnel Training Coordinator, Simulation Engineer, PD Trng Rep, Payload Simulation Director, Increment Simulation Supervisor, Payload Simulation Coordinator

Agenda:		
	• Science Team Definition (team structure and functions)	PD
	• Science Team Training Plan Discussion:	
	- Internal Team Training	PD
	- POIC Interface Training	GTI
	- Participation in Simulations	PL Sim Dir.
	• Assign actions and due dates	GTI

Post TIM Activities & Products:

Finalize Science Team Training Plan for Payload/Experiment	GTI
Work actions	Actionees
Distribute minutes of this TIM	GTI

POSWG #2 GSP Payload Complement Training
(Conducted per Payload Complement)

Objective: *To allow the Payload Simulation Director to define high level requirements for Payload-Only Simulations for the GSP for the Payload Complement.*

Attendees: Payload Simulation Director (Chair), Simulation Engineers, PD Trng Reps, Payload Simulation Coordinator, Payload Ground Support Personnel Training Coordinator, Increment Sim Sup, MSFC POIF Reps, Ground Training Integrator

Agenda:		
	• GSP Payload-Only Simulations: - What types of GSP-only simulations are necessary for this Payload Complement - How many of each type of simulation is necessary - Timeframe for each type of simulation - How many hours for each simulation - Main objectives for each simulation	PL Sim Dir
	• Issues to Resolve	All
	• Assign actions and due dates	PL Sim Dir

Post POSWG Activities & Products:

Document Simulation Plan	PL Sim Dir
Update Simulation Schedule	PL Sim Dir
Work actions	Actionees
Distribute minutes of this TIM	PL Sim Dir

TST #2 **Payload Complement Status to Payload and Ground Training Integrators**
(Conducted per Payload Complement)

Objective: *To provide a status of crew and GSP training requirements for the Payload Complement.*

Attendees: Payload Ground Support Personnel Training Coordinator (co-Chair), Payload Simulation Director (co-Chair), Payload Training Integrator, Increment Simulation Supervisor, Payload Simulation Coordinators

Agenda:		
	• GSP Training Plan Status: - Generic Operations, Position Specific, and Payload-Specific Training - Cadre Training Courses/Objectives - Science Team Training Courses/Objectives - Payload Instructor Training Status - Payload-Only Simulations Hours/Objectives - Training Issues/Concerns	PGSPT Coord.
	• Payload Integrated Simulations Status: - Integrated Payload-Only Simulation Hours/Objectives - Payload Participation in JMST Hours/Objectives - Integrated Simulation Issues/Concerns	PL Sim Dir.
	• GSP Training Schedule	PGSPT Coord.
	• Other Issues/Concerns • Actions	All

Post TST Activities & Products:

Work actions	Actionees

APPENDIX D

DESCRIPTION OF SIMULATOR FIDELITIES

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D, DESCRIPTION OF SIMULATOR FIDELITIES

A system for classifying both integrated simulators and their individual components has been devised to help coordinate simulator requirements, approach, and capabilities. This system involves classifying integrated simulator systems into classes based on their overall design approach, as well as classifying the simulator components into fidelity levels.

SSTF/PTC

The five simulator classes are defined as follows:

Class I Flight Equivalent Unit (FEU) - May be an engineering unit, a non-qualified flight item, or a non-radiation hardened COTS equivalent

Class II Software Simulation with Hardware Panels/Interfaces

IIa - SW simulation in the SSTF/PTC Host computer (not currently supported)

IIb - SW simulation in user-provided computer

Class III Software Simulation with Virtual Panels/Interfaces

IIIa - SW simulation in SSTF/PTC Host computer (not currently supported)

IIIb - SW simulation in user-provided computer

Class IV Hardware Panel Only - Panels with limited or no simulation and no interfaces to the SSTF core system simulations.

Class V Inert Object - Picture or inert 3-D mockup.

SSTF PTC requirements do not include support for Class IIa or Class IIIa PTSs, so no provision has been made to allow PTS software to execute in the SSTF session host computers. Class I PTSs and FEU components of other PTSs can be accommodated in the SSTF, provided any resources (fluids, vacuum, power, etc.) beyond those included at the SIP are provided by the PD, and that the PTS and all support resources are contained within a volume equivalent to an SSTF ISPR. Any additional resources shall be documented in the PDL dataset. All components and support equipment for a PTS of any class shall comply with the handling procedures and limitations in Appendix I, Sections 10.5 and 10.6. Details

of the PTS implementation will be documented in the PDL dataset and the PTS User's Guide.

SSMTF

Three types of hardware are required to address the appearance, tolerance, and composition of simulators/trainers/mockups at the SSMTF.

Class I

a. Flight Assembly Tolerance - Conforms to flight (or ground) article dimensions, but is not flight qualified.

b. Similar Materials - Materials are of same family and characteristics as the flight article, but are not necessarily the same grade.

c. Exact Configuration - Appearance is like flight article in all aspects.

Class I hardware is typically used for crew (or ground) training, or engineering verification exercises.

Class II

a. Relaxed Assembly Tolerance - Not held to flight specifications; margins to be specified by requirements documents.

b. Mixed Materials - Materials meet general characteristics of flight article and optimally support the intended function, but need not be of the same family, grade, or specification.

c. Approximate Configuration - Appearance is similar to flight article (size, shape, color, orientation, location, etc.).

Class II hardware is typically used for crew (or ground) training or design development.

Class III

a. Approximate Dimensions - Anticipated volumetric approximation.

b. Optional Materials - Materials support facility objective.

c. Configuration - Appearance to depict design or anticipated concept.

Class III hardware is typically used for concept formulation or preliminary layout. It is also used for portions of a training facility that do not require active student operations and would otherwise remain void. Example: a module window that crew training does not address.

INDIVIDUAL COMPONENTS

The fidelity of the individual components that make up a simulator can be described by the following five levels. (Note that substitution of materials is acceptable for all fidelity levels.)

Total Fidelity (T): All functional and physical characteristics of the payload elements will be representative of the flight design for use in the appropriate environment. Construction will be to flight article drawings with deviations allowed in materials, finishes, coatings, weld quality, and inspection requirements. Example: A control and display panel that has switches and displays will be identical in appearance and feel to the flight article and will respond correctly to operation of the controls. This fidelity also includes flight hardware that was procured for training purposes, backup flight hardware, or an engineering model.

Functional Fidelity (F): All functional characteristics of the payload elements will be representative of the flight design for use in the appropriate environment. Physical characteristics are not required. Example: A switch that does not have the same characteristics as the flight article, but does function to turn on the appropriate item of equipment. Another example is a software simulation driving a virtual panel or Cathode Ray Tube (CRT). All components are represented and, when operated, create the proper system response.

Physical Fidelity (P): All physical characteristics of the payload elements will be representative of the flight design for use in the appropriate environment. Functional characteristics are not required. Example: A control panel that has switches and knobs that are mechanically operable, having the same appearance and operating force and movement as the flight article, but which are not connected to produce a system response or display.

Envelope Fidelity (E): Exterior shape and color of the payload elements will be representative of the flight design. In general, this hardware is used to verify component location within the appropriate environment. Example: A wire bundle that is a volumetric representation for external appearance.

Visual Fidelity (V): Physical and functional characteristics are not required. Front panels in proper location representative of flight article, but are inert mockups or pictures/drawings of the flight panel. They have no operational switches/displays or

functional software. Examples: Photograph mounted on life-sized panel, a plastic/metal mockup painted to look like the flight item, drawing of the flight panel mounted in appropriate location for completeness of overall flight environment for training correctness.

APPENDIX E

U. S. PAYLOAD TRAINING DRY RUN

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E, U. S. PAYLOAD TRAINING DRY RUN

Definition:

A Payload Training Dry Run will be held for each payload or experiment course to prove the readiness of the facilities, instructors, training equipment/products as well as the schedules for meeting all crew training requirements for that payload or experiment. OBT products will also be certified at this time.

Review Lead: Payload Instructor or Payload Designee

Chair: Sim Engineer

Participants:

Sim Engineer (SE)
Crew Representatives
Payload Developer Representatives
Applicable Payload Instructors (PD, SE or JSC instructor)
Program Office Representative (invited)
U.S. Payload OBT Representative (if applicable)

Timeframe:

Review will be held approximately six weeks prior to training for that payload or experiment or set of payloads or experiments. (NOTE: Schedule modifications may be made on a case-by-case basis to accommodate instructor travel needs.) This will allow for 2 weeks to make any corrections, a delta PTDR and time for translation of materials if required.

OBT product reviews will be held approximately 6 months prior to OBT product launch. This allows the PD 4 weeks to make any corrections or modifications to the OBT product and to have a delta PTDR if required.

Objectives:

- Demonstrate instructional and functional training readiness to the Sim Engineer/Crew Rep in the form of a dry run of training sessions
- Validate Payload Training hours estimated during TST #1.
- From TST #1/OBT TDR, assure Issues/Concerns from TST #1/OBT TDR as related to this payload's or experiment's training are closed.
- Demonstrate that procedures and displays are as flight-like as possible and ready for training in courses utilizing displays and procedures.

Action Items:

The Sim Engineer (SE) will document Action Items, issues, and concerns resulting from PTDR. The Action Items requiring Program Office decision will be relayed to the PTP by the SE for tracking and closure.

The SE will take minutes of the meeting documenting the PTDR agreements, issues, and action items and distribute them to the attendees and the PTI. Besides agreements, issues, and action items, the PTDR minutes should include the following information as a minimum per lesson: (1) TAMS class title; (2) PTDR date; (3) Increment/Flight lesson or OBT product used (for example: I1 only, I2 and subsequent, etc.); (4) Instructor; (5) SE; (6) Crew Rep; (7) actual time of lesson vs. predicted time of lesson; (8) status of PTDR (i.e., " Ready for Training" or "Ready for Training with Closure of Actions") and include Action Item due dates (Note: If changing procedures is an action item, include date PD will submit changes to PODF and date negotiated with PODF when changes can be verified and ready for training.); (9) PTDR Evaluation Checklist Signatories; (10) Ready for Training date; (11) Delivery date for OBT product to U.S. Payload OBT Rep, if applicable.

All ITIs, CAMs, and the U.S. Payload OBT Rep (if applicable) will be on distribution for the PTDR Evaluation Checklist Summary so that they will know when sessions are approved for training. The PTI will also maintain a list of all courses, instructors and Summary signatories for each increment. This list will be used by the PTI to verify course certification with the CAM prior to scheduling and with Planning personnel for any OBT.

Guidelines and Requirements:

Payload Developer Crew Procedures and functional/integrated displays required for completion of the objectives for the session must be validated by the PD and verified against the ODF standards by PODF/PDRP personnel prior to the PTDR.

The SE will notify the Crew office's Operations Rep so that appropriate Crew Representatives can be assigned to attend the PTDR. Notification to the entire participant list will then be made by the SE at least 2 weeks prior to the PTDR.

Lesson plans, courseware, and prerequisite materials will be provided to the SE by the Review Lead 2 weeks prior to PTDR, and the SE will forward the material to the appropriate Crew Rep at least 5 working days prior to PTDR.

The SE will provide the PTDR Evaluation Checklist and the /Explanation of PTDR Evaluation Checklist Items that will be used by the evaluators.

The SE and the Crew Representative, as official PTDR evaluators, will sign the PTDR Evaluation Checklist for each PTDR session designating the status of the PTDR as complete, complete when actions items are closed and documented, or incomplete (requiring a delta PTDR).

PTDR Evaluation Checklist can be completed by any training session participant/attendee and will be considered by the SE and Crew Rep in their final evaluation of the training session.

The PTDR should be treated exactly like crew training. The training session will not be interrupted by non-participating attendees. All comments, questions, and concerns should be addressed at the completion of the training session dryrun.

Delta PTDR will be scheduled at the recommendation of the SE, Crew Rep, or PD. Delta PTDRs for reflight payloads will be required for changes to on-orbit configuration and operations, changes to previously flown and certified OBT products, or instructor changes.

After the PTDR, the SE, Crew Rep, and PD should assess the hours planned for the session vs. actual hours taken. The SE should notify the PTI of any changes to the training hours required, and the PD should adjust the hours in PDL. They should also address proficiency requirements for the particular lesson as well as any OBT requirements.

PTDR EVALUATION CHECKLIST SUMMARY

CHOOSE ONE: ☐ (Lesson and Instructor Eval), ☐ (Instructor Only Eval), ☐ (Lesson Only Eval)

DATE: _____

INCREMENT/FLIGHT: _____

EVALUATOR NAME: _____

PAYLOAD/HARDWARE: _____

SESSION/OBT PRODUCT TITLE: (Same as in TAMS) _____

_____

INSTRUCTOR: _____

SE: _____

CREW REP: _____

ATTENDEES:

_____

_____

_____

_____

_____

DURATION OF DRYRUN TRAINING SESSION: _____ Planned _____ Actual _____ Recommended Course Length

ACTIONS:

_____

_____

_____

_____

EVALUATION STATUS (Check all that apply):

☐ LESSON READY FOR TRAINING ☐ INSTRUCTOR READY FOR TRAINING

☐ LESSON AND/OR INSTRUCTOR READY FOR TRAINING WHEN ACTIONS CLOSED

☐ A DELTA PTDR LESSON OR INSTRUCTOR EVAL REQUIRED

☐ OBT PRODUCT READY FOR DELIVERY

_____	_____	_____
SE Signature (Required on all evals)	Crew Rep Signature (Not required for Instructor	PD Signature (Only required for Instructor

Only Eval)	Only Eval)

PTDR EVALUATION CHECKLIST

CHOOSE ONE: ☐ Lesson and Instructor Eval, ☐ Instructor Only Eval, ☐ Lesson Only Eval
☐ OBT Product Eval

EVALUATOR NAME:_____ **DATE:** _____

PAYLOAD/HARDWARE:_____

SESSION TITLE/OBT PRODUCT:_____

INSTRUCTOR:_____

LESSON EVALUATION	YES	NO	N/A	Comments	Delta Evaluation
Course content developed per Lesson Plan					
Training Objectives Established					
Training Objectives Accomplished					
Prerequisite Materials Acceptable					
Courseware/Handouts/Materials acceptable (procedures/ displays/OBT products)					
Training Hardware meets lesson objectives					
Increment Specifics given					
Appropriate lesson length					
Appropriate lesson detail					
OCBT Requirements Met: Virus Signature Evaluation Compliance Matrix received OPS LAN Compliance Memo Corrective Actions completed					

INSTRUCTOR EVALUATION	YES	NO	N/A	Comments	Delta Evaluation
Instructor Followed Lesson Plan					
Instructor Adequately Prepared - classroom/facility support planned objective - required H/W and materials available for training - validated and verified crew procedures available (if required)					
Instructor gave appropriate level of detail					
Enthusiasm toward subject matter					
Questions answered adequately					
Material covered thoroughly and completely					
Instructor has adequate knowledge of subject matter					
Instructor involved students					
Instructor has ability to present material					
Instructor used time effectively					

IF ACTIONS WERE GIVEN, CHECK HERE ☐ AND SEE CHECKLIST SUMMARY

DEFINITION/EXPLANATION OF PTDR EVALUATION CHECKLIST ITEMS

All areas should be assessed for training effectiveness. If negative training is identified in any area, please note in the comments column in the affected area.

LESSON EVALUATION	Definition/Explanation
Use this section for PTDR of lesson only evaluation	
Course content developed per Lesson Plan	Prior to PTDR review the lesson plan. Did the course follow the lesson plan?
Training Objectives Established	Chart(s) on session Training Objectives was presented. Handouts were available if needed.
Training Objectives Accomplished	All established objectives were accomplished. Was all the information covered? Did the student participate as required? Were training objectives achieved?
Prerequisite materials acceptable	Materials were in the appropriate format depending on the type of information presented, i.e. tables, displays, pictures, etc. Materials were organized and presented in a logical manner at the appropriate technical level for the crew.
Courseware/Handouts/Materials Acceptable (Procedures/displays/OBT products)	As above under Prerequisite materials. Payload/Experiment displays, Crew Procedures and the OBT products required for the session were available, validated, verified, and functional for training. Required products interfaced correctly.
Training hardware meets lesson objectives	Training H/W Fidelity reflects the specification agreements per the PSRD or equivalent requirements document. Sim engineer should verify prior to PTDR.
Increment specifics given	Mentioned any known changes from other increments.
Appropriate Lesson Length	Compare to Scheduled time for class.
Appropriate Lesson Detail	Did the student achieve the lesson objectives?
On-Board Training Requirements met	Did the sim engineer ensure prerequisites completed and approval of the OBT product as having met the requirements of the OBT Media Requirements or were waivers in place?

INSTRUCTOR EVALUATION	Definition/Explanation
Use this section for PTDR of lesson & instructor or instructor only evaluation	
Instructor followed Lesson Plan	Pre-PTDR review Lesson Plan. Did the instructor clearly convey the training objectives/expectations at the start of the session?
Instructor adequately Prepared - classroom/facility support objectives - required H/W and materials available - validated/verified displays, procedures, OBT products	Viewgraph machines, VCRs, TVs and other support equipment set-up prior to the session (as required) and during the training session. Facility support available and responsive to problems. Classroom, tables, chairs, equipment and other furniture adequate. All training hardware/software required was present and functioning per requirements stated in the objectives and the fidelity/functionality was per TST requirements.
Instructor Gave Appropriate Level of Detail	Did the student achieve the objectives? Was the appropriate level of knowledge provided for the skill, knowledge, or attitude to be trained?
Enthusiasm toward subject matter	Instructor appeared to be genuinely interested in the subject and projected this interest to student.
Questions Answered Adequately	If answers unknown did Instructor take the action to get the answer to the student?
Material covered thoroughly and completely	Instructor was concise, thorough and adequately prepared on technical aspects.
Instructor has adequate knowledge of subject matter	Instructor was able to present the material without continual reference to notes and could answer most questions.
Instructor involved student(s)	As a means to evaluate the skill or knowledge level of the student and to meet the objectives of the class
Does instructor have ability to present material in this medium	Was the instructor comfortable and professional with the audience?
Instructor used time effectively	Instructor did not ramble; information was complete.

GUIDE TO USING THE PTDR EVALUATION CHECKLIST

PTDR Evaluation Checklist can be completed by training session participants/ attendees and will be considered by Sim Engineer/Crew Rep in their final evaluation of the training session.

OBJECTIVES

Provide record of comments on the PTDR to help the Sim Engineer/Crew rep. Complete the Summary Evaluation/Assessment of the PTDR.

EVALUATION PROCESS

Important: The PTDR should be treated exactly like crew training. The training session dryrun should not be interrupted by non participating attendees. All comments, questions, and concerns should be addressed at the completion of the training session dryrun.

Complete as much of the form as possible prior to the start of the session.

Complete the remainder of the checklist during or immediately following the session. Be as concise but as complete as possible. Additional comments not fitting on the checklist are welcome and may be attached.

Give the checklist to the Sim Engineer at the end of the PTDR.

APPENDIX F

PAYLOAD CHANGE REQUEST PROCESS

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F, PAYLOAD LESSON CHANGE REQUEST (PLCR) PROCESS

Appendix will be completed by DT personnel.

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APPENDIX G

ROLES AND RESPONSIBILITIES

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TABLE G-1 ROLES AND RESPONSIBILITIES FOR PLANNING (Sheet 1 of 3)

PLANNING	PTI	SIM ENGR.	PL INSTRUCTOR	ITI	SSTF/ PTC REP	PL DEV	GSP TRAINING COORD	SIM DIR
Multi-Increment Planning	Assesses PL Complement trng requests for PL compatibility as submitted in MER (4-5 years prior to launch)	Assesses individual Pl Trng requests against similar PLs	N/A	Provides Generic template for PL training hours available for a Shuttle or Soyuz crew	N/A	Provides PL Trng requests via the MER	N/A	N/A
Tactical Planning	Assesses PL Complement trng reqs for PL compatibility as submitted in PIA &PL Trng Data Set (2-3 years prior to launch), Negotiate PL training hours availability with ITM, provide consolidated training input to Ops Feasibility Assessment	Assesses individual Pl Trng requirements, begin Trng Strategy Team Process to finalize reqs	N/A	Provide PL training hours available for specific crew sets. Negotiate PL training availability with PTIM	N/A	Provide PL Trng requirements via the PDL and PIA	N/A	N/A
Crew Payload Training Objectives/ Requirements Development	Integrates crew PL Trng Req per PL Complement	Leads Crew Training Req definition, Chairs PL TIMs and TST #1	Provides technical support	N/A	N/A	Provides PL expertise, Defines Req	N/A	N/A
GSP Training Requirements Development (POIF provided training)	Integrates GSP PL Trng Req per PL Complement, Chairs TST #3 (Sims and GSP Trng in TST #3)	Provides PL knowledge to assist in defining PL trng reqmts	N/A	N/A	N/A	Provides GSP Trng Coor w/ PD Team ID Info	Leads POIF cadre and POIF provided PL Dev Training Requirements Definition	N/A

TABLE G-1 ROLES AND RESPONSIBILITIES FOR PLANNING (Sheet 2 of 3)

PLANNING	PTI	SIM ENGR.	PL INSTRUCTOR	ITI	SSTF/ PTC REP	PL DEV	GSP TRAINING COORD	SIM DIR
Payload Simulator Requirements Development	Mgt Responsibility	Provides guidance during TST process to ensure that program reqs are met, develops simulator reqmts w/ PD	Provides technical support in defining requirements	N/A	Provides SSTF/PTC facility expertise, reviews Trainer Specification Document	Provide PL expertise, jointly define simulator reqs. Develops Trainer Specification Document	N/A	N/A
Payload Complement Requirements Development	Defines PL Compl Req., Chairs PL Complement TST #2	Provides technical support	Provides technical support	N/A	N/A	N/A	N/A	N/A
Integrated Simulation Payload Requirements Development	Mgt Responsibility, Conducts TST #3 to Approve Simulation Req (Sims and GSP Trng in TST #3)	Provides technical support	Provides technical support	N/A	N/A	N/A	Provides GSP Trng History	Leads Integrated PL Simulation Requirements Definition, Provides PL input to STL for JMST
Payload Instructor Trng Requirements Development	Mgt Responsibility	Leads PL Instructor Requirements Definition	Provides SSTF/PTC Trng Req for Instructors performing PTC PL training functions	N/A	Represent SSTF/PTC Facility	Provides PL expertise, Defines Req for training instructor on PL	Documents Instructor Training Requirements	N/A
Training and Certification of PL Instructors	Ensures Instructors are certified prior to crew training start	Trainee	Trainee	N/A	N/A	Trainee	Training Administration	N/A

TABLE G-1 ROLES AND RESPONSIBILITIES FOR PLANNING (Sheet 3 of 3)

PLANNING	PTI	SIM ENGR.	PL INSTRUCTOR	ITI	SSTF/ PTC REP	PL DEV	GSP TRAINING COORD	SIM DIR
Payload Complement Training Plan	**Integrates Trng reqs across a PL Complement, provides integrated input to PL Trng Data Set, Book Manager**	Provides Individual PL Crew Trng reqs to PTIM	N/A	N/A	N/A	N/A	Provides GSP trng reqs to PTIM	Provides Integrated Simulation reqs to PTIM
Payload Simulator Requirements Document, Vol 2	Mgt Responsibility	**Writes PSRD Vol. 2, Book Manager**	Provides technical support	N/A	Reviews PSRD Vol. 2	Works with Sim Engineer, provides PL data	N/A	N/A
Multilateral Increment Training Plan	Provide Payload Trng Reqs input	N/A	N/A	**Integrates all trng reqs across ISS per increment, Book Manager**	N/A	N/A	N/A	N/A

Note: Bold boxes indicate primary responsibility

TABLE G-2 ROLES AND RESPONSIBILITIES FOR DEVELOPMENT (Sheet 1 of 2)

DEVELOPMENT	PTI	SIM ENGR	PL INSTR.	SIM DIR.	STL	FACILITY REP	PL DEV
Trainer/Simulator Development	Management Responsibility, Coordinate schedule and milestones by Increment	Manages Payload schedules, oversees reqts, Provides Technical Assistance to PD in implementing PSRD req	Coord JSC Trng Facilities w/Sim Engr, Develop IOS Displays	N/A	N/A	Provides facility technical assistance to the Sim Engr, Implement I/F to SSTF	Develops Simulator, Implements PSRD Requirements
Crew Payload Training Lesson Plan Development (for Individual P/L Training Instruction)	Management Responsibility, Coordinate schedule and milestones by Increment	Writes PTLP in coordination with the PD for JSC Trng, When PD is instructor, reviews PD developed lesson plans	Provides assistance to the Sim Engr.	N/A	N/A	N/A	Provides input to Sim Engr for PTLP development or writes PTLP for PDC trng
PL Complement Training Lesson Plan Development	Provides PL Complement Training Requirements	Writes PL Compl Trng Lesson Plan	Provides technical assistance to the Sim. Engr.	N/A	N/A	N/A	Provides input to Sim Engr for PCTLP development
Joint Systems & Payloads Training Instruction Planning/Script Development	Management Responsibility	Provides payload script inputs, technical assistance to STL	Provides payload script inputs, technical assistance to STL	N/A	Leads script development	N/A	Provides input for training events (optional)
Payload-Only Simulation Planning/Script Development ([MSFC only] and [MSFC&SSTF/PTC])	Management Responsibility	Provides payload script inputs, technical assistance to Sim Director	Provides payload script inputs, technical assistance to Sim Director	Leads script development	N/A	N/A	Provides input for sim events (optional)
Joint Integrated Simulation Planning/ Script Development (for JIS/JMST)	Management Responsibility	Provides simulation events, technical assistance to the Sim. Dir.	Provides simulation events, technical assistance to the Sim. Dir.	Develops script for payload portion of all sims	Leads JIS/JMST script development	N/A	Provides input for sim events (optional)

TABLE G-2 ROLES AND RESPONSIBILITIES FOR DEVELOPMENT (Sheet 2 of 2)

DEVELOPMENT	PTI	SIM ENGR	PL INSTR.	SIM DIR.	STL	FACILITY REP	PL DEV
Simulator Pre-Shipment Test	Management Responsibility	Conduct test, signs off	Support as required	N/A	N/A	N/A	Host test, fixes discrepancies, signs off
Payload Simulator Inventory and Interface C/O (PSIIC) Phase 1&2	N/A	Conducts Phase 1 (inventory and test per PSRD Vol 2 - signs off) Support Phase 2	Support for info on simulators	N/A	N/A	Conducts Phase 2 (inventory as GFE, initial interface tests per JSC scripts) Support Phase 1	Assist if required
Payload Simulator Integration into SSTF/PTC	N/A	Support facility integrations, perform and signoff subrack integrations	Support for simulator info, provide IOS pages	N/A	N/A	Perform and signoff facility (rack-level) integrations and final test	Support integration and fix simulator as necessary
Payload Simulator Acceptance Test (PSAT)	N/A	Writes PSTP and Conducts Test, signs off	Support	N/A	Support Systems	Facility support	Support as required
Payload Training Readiness Review (PTRR)	Management Responsibility	Conducts Test--If sim engineer is not instructor, Lead (dual sign off w/ crew rep); If sim engineer is instructor, Incr Lead sim Engr or Lead's rep is lead (dual sign off w/ crew rep)	Assists SE in Conducting Tests	N/A	N/A	Facility support	Participate if required
Payload Complement Simulator Verification	Lead	Conducts Tests	Assists SE in Conducting Tests	N/A	N/A	Facility support	Support

IMPORTANT! - "Instruction" denotes crew only, "Simulation" means flight controllers and crew

TABLE G-3 ROLES AND RESPONSIBILITIES FOR SCHEDULING (Sheet 1 of 3)

SCHEDULING	PTI	ITI	CTC	CAM	PL DEV	STL	SIM DIR	GSP TRNG COORD	PL INSTRUCTORS	FACILITY REP
Increment Specific Long Range Crew Training Template (US/Partner allocation of training time)	Recipient of schedule, begin preliminary planning	Develops schedule between I-24 and I-19	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Detailed Crew Training Plan (week by week schedule @ Lesson Level)	Provides MITP inputs (crew trng req) to ITM/CAM	Provides schedule input via MITP @ I-19, approves new reqs for incorporation into plan	Recipient of schedule, begins preparations for training execution by coordinating with PL Dev and trng personnel	Develops Prel schedule @ I-19, Basic @ I-18, updates as required	Begins plans for training	Begins Simulation Planning	Begins Simulation Planning	N/A	N/A	N/A
Weekly Crew Activity Schedule (Daily Agendas)	Provides requirements changes	Approves requirements changes	Coordinate w/CAM, PD and Instructors to finalize PL trng schedule	Begin Developing Prel schedule 2 weeks prior to trng. Final comes out on Thursday prior to scheduled week	Interface w/CTC to receive trng schedule information	Work with Sim Dir and CAM to schedule simulations	Work w/ CTC and STL to coordinate simulation dates	N/A	Recipient, plan training	N/A

TABLE G-3 ROLES AND RESPONSIBILITIES FOR SCHEDULING (Sheet 2 of 3)

SCHEDULING	PTI	ITI	CTC	CAM	PL DEV	STL	SIM DIR	GSP TRNG COORD	PL INSTRUCTORS	FACILITY REP
PL Complement &Individual Payload Training Event Scheduling	N/A	N/A	Coordinate changes to final schedule w/CAM, PD and Instructor	Schedule Facility and Crew; Coordinate changes w/CTC	Interface w/CTC to receive trng schedule changes	Schedule SSTF team as required	N/A	N/A	Interface w/CTC to receive training schedule changes; ensure MOD Training Request Forms are valid	Ensure facility resources are available.
Systems & Payload Training Event Scheduling	N/A	N/A	Evaluate PL Support capability	Show event on crew and facility schedule	Interface w/CTC to receive training schedule information	Schedule SSTF team as required	N/A	N/A	Interface w/CTC to receive training schedule information, ensure MOD Training Request Forms are valid	Ensure facility resources are available
Payload Only Simulation Scheduling (MSFC Only)	Mgt Responsibility	N/A	N/A	N/A	N/A	N/A	Schedule simulations, Coordinate w/CAM when crew participates, Provide schedule data to PD	N/A	N/A	N/A

TABLE G-3 ROLES AND RESPONSIBILITIES FOR SCHEDULING (Sheet 3 of 3)

SCHEDULING	PTI	ITI	CTC	CAM	PL DEV	STL	SIM DIR	GSP TRNG COORD	PL INSTRUCTORS	FACILITY REP
Payload Only Integrated Simulation Scheduling (MSFC and SSTF/PTC)	Mgt Responsibility	N/A	When crew participates, coordinate w/ Sim Director and CAM to ensure crew is scheduled	Schedule facility & crew; coordinate changes w/CTC	Interface w/CTC to receive training schedule information	Schedule SSTF team as required	**Schedule simulations; coordinate w/CTC when crew participates; provide schedule to PD and PL Instructors**	N/A	Interface w/CTC to receive training schedule information, ensure MOD Training Request Forms are valid	
Joint MST Scheduling	N/A	N/A	N/A	Show JMST on crew schedules, negotiate dates w/ STL	N/A	**Coordinate and Schedule JMST, coordinate w/ CAM, Sim Dir and facilities to schedule sims**	Coordinate w/STL for PL participation, Provide schedule data to PD	N/A	N/A	N/A
GSP Trng Scheduling	Mgt Responsibility	N/A	N/A	N/A	N/A	N/A	N/A	**Schedule POIF cadre & PD trng**	N/A	N/A

Note: Bold boxes indicate primary responsibility

TABLE G-4 ROLES AND RESPONSIBILITIES FOR IMPLEMENTATION

IMPLEMENTATION	PTI	CTC	SIM ENGR.	PL INSTRUCTOR	STL	SIM. DIR.	FACILITY REP	PL DEV	GSP TRAINING COORD
Payload Training Preparation/Setup	N/A	Responsible for Coordinating Setup	Prepares if Assigned as instructor	Prepares if assigned as instructor	N/A	N/A	Provide Facility Support	Prepares if assigned as instructor	N/A
Individual Payload Training Instruction	N/A	Attends trng, Tracks Actions	Instructs as required	Instructs as required	Coordinate systems support/ operations as reqd.	N/A	Provide Facility Support	Instructs as required	N/A
Payload Complement Training Instruction	Assists in Script Development	Responsible for Coordinating p/l set-up; Attends trng, Tracks Actions	Increment Lead develops script, Instructs as required	Instructs as required	Coordinate systems support/ operations as reqd.	N/A	Provide Facility Support	Instructs as required	N/A
Joint Systems & Payloads Training Instruction	N/A	Coordinate w/ STL, Tracks PL Actions	Increment lead makes payload script inputs to STL, Instructs as required	Instructs as required	Leads; Responsible for coordinating set-up	N/A	Provide Facility Support	Instructs as required	N/A
Payload-Only Simulation Execution (MSFC only)	Management Responsibility	N/A	Works payload as required	Works payload as required	N/A	Leads	Provides facility support	N/A	N/A
Payload-Only Simulation Execution (MSFC & SSTF/PTC)	Management Responsibility	N/A	Instructs as required	Participate as instructors	Coordinate systems support/ operations	Leads	Provides facility support	N/A	N/A
JIS/JMST Execution	MSFC Management Responsibility	N/A	Works payload as required	Works payload as required	Leads	Provides payload input	Provides facility support	N/A	N/A
Training Recordskeeping	Verifies PL Complement Trng Reqmts met	Submits Training Report for Trng not conducted by PTC Instructor or Sim Engineer	Submits Training Report in TAMS (within 48 hrs) for PTC Trng	Submits Training Report in TAMS (within 48 hrs) for PTC Trng	Submits Training Report in TAMS (within 48 hrs) for Integrated Simulations	Provide PL trng input to STL for Payload Only sims)	N/A	N/A	Maintains GSP Training Database

IMPORTANT! - "Instruction" denotes crew only, "Simulation" means flight controllers and crew

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APPENDIX H

TO BE RESOLVED ITEMS

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H, TO BE RESOLVED ITEMS

H.1 PURPOSE

Appendix H contains a matrix listing the specific items within the document that are not yet resolved. Each item is given a TBR number using the section of the document that contains the item as the first digit and a consecutive number for the second digit. The item is identified in detail including the affected section, as well as a description of the TBR item. Each specific TBR item is listed once with all of its associated affected section numbers. As each TBR item is resolved, the correct text is inserted in place of the TBR in the document and the entry is removed from this matrix.

TBRs will be identified in the document by placing a bold-typed TBR number in brackets immediately after that text (i.e., <**TBR 3-1**>).

TABLE H.1-1 MATRIX OF TO BE RESOLVED ITEMS

TBR NUMBER	DESCRIPTION	AFFECTED SECTION(S)	ORIGINATOR
6-1	Payload training must work to I- dates. SSTF/PTC personnel contractually work to L- dates. Affects all templates where SSTF/PTC personnel are involved.	Figure 6-2 Figure 6-3 Figure 5-1 6.2.3, 6.2.4,	NASA
6-2	Live specimen training in SSMTF is not assured. New space is being looked at for this activity at JSC.	6.3.2.G	NASA

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